An Exploration into How Design Can Better Align the Attributes of Luxury and Sustainability for 'High-End' Hotel Guest Rooms

By

Ruba JadAllah

P14018813

A thesis submitted for the degree of

Doctor of Philosophy

In the School of Design
Faculty of Art, Design and Humanities
De Montfort University

September 2018

DECLARATION

I declare that this thesis, which I submit to De Montfort University, has been composed entirely by myself and it has not been submitted for any other degree or professional qualification.

Name of candidate: Ruba JadAllah

Signed ……..

Date ……

APPROVAL

The undersigned certify that they have read and recommended to the graduate school, De Montfort University for acceptance of the thesis entitled 'A design guide of luxury sustainable material finishes for high-end sustainable hotel guestrooms: carpet as a case study' submitted by Ruba JadAllah in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

First supervisor:

Prof. Peter Ford

Professor of Design

Head of Commercial Design

School of Design

De Montfort University

Signed: ……

Date: …….

Second supervisor:

Assoc. Prof. Rosemarie Fitton

Associate Professor

Subject Leader in Interior Design

School of Design

De Montfort University

Signed: ……

Date: ……

ABSTRACT

There would appear to be a tension between luxury and sustainability within the hotel industry. Luxury, sustainable hotels appear to focus more on adopting sustainable practices for financial benefit, often resulting in a conflict between comfort and hotel guest satisfaction. Hotel owners tend to focus on being sustainable in terms of operational procedures, typically asking the guests to decline room service for three days. Moreover, there is a lack of information for designers to follow in being guided in the design of sustainable environments, with interior designers tending to restrict themselves to less involved aspects of the design process, focusing on aesthetics while ignoring sustainability issues, such as emissions reduction and the impact of this on occupants' health and well-being, and on energy savings. This lack of balance is due to the minimal knowledge about sustainability issues, meaning designers may not have the confidence to design sustainably. Additionally, most of the available information about sustainable materials is focused on construction and the lack of comprehensive accessible data on the selection of sustainable interior materials.

Most existing environmental assessment tools (such as BREEAM in the UK) focus on construction materials. In addition, the Building Research Establishment for Environmental Assessment Method (BREEAM) does not cover the hospitality industry, including the luxury hotel sector. The environmental profiles produced by the building research establishment (BRE) are mainly focused on construction materials; but, nevertheless, these environmental profiles are beneficial for designers to use in life-cycle assessment during concept design stages. Because running life-cycle assessment (LCA) of material finishes consumes time and needs large amounts of data about the material to be produced, it is not always appropriate during the design concept stage. This research therefore proposes a design guide for luxury sustainable material finishes for high-end hotel guestrooms (carpets being used as a case study) in the luxury hotel industry (typically in London) that aligns a definition of luxury with sustainable materials, where the designer will be able to select and rate a luxury material that is also sustainable.

This study adopts a mixed-methods approach, using the Dorchester Hotel in London as the case study. Interviews with 14 professionals (designers, manufacturers, hotel managers and BREEAM

directors) and two online questionnaires (one questionnaire with 34 designers and the other questionnaire with 12 luxury hotel guests).

The data collected was analysed using visual inspection, content analysis and descriptive statistics analysis. The findings of this data helped in producing a carpet test questionnaire which was conducted among 25 academics to produce luxury carpet specifications which were then analysed using descriptive statistics analysis. The interviews with professionals confirmed the research problem, which is the relationship between a designer's ability to specify sustainable, luxury materials and the interest of hotel managers in sustainable solutions that reduce costs. Designers emphasised the need for a design guide that helps in selecting sustainable materials for luxury hotels. The case study, questionnaires, interviews and relevant literature informed the researcher in developing such a design guide. The design guide model is therefore intended to assist designers in selecting materials that are both luxurious and sustainable. An initial evaluation of this design guide shows an acceptance from designers in its use, citing the reduced time needed for the specification and application of appropriate materials and finishes.

This research will produce a definition of luxury material finishes, specifically a definition of luxury carpet for high-end hotel rooms and the means to measure a luxury carpet via a design guide that combines luxury with sustainability. Therefore, this research will help designers select luxury, sustainable materials and finishes for luxury hotel projects and in so doing, encourage hotel owners to adopt sustainability within their hotel interior designs.

DEDICATION

To my beloved parents: I could not have done this without your support and blessings and I can never thank you enough for all your unconditional love and support.

ACKNOWLEDGEMENTS

I would like to extend thanks to the many people who so generously contributed to the work presented in this thesis.

First and foremost I would like to thank the kindest, most enthusiastic and supportive supervisors, **Prof. Peter Ford** and **Assoc. Prof. Rosemarie Fitton.** My PhD has been an amazing experience, and I would like to thank you both not only for your professional academic support, but also for your deep understanding, encouragement, advice and your supportive, kind words that kept me going during tough times in my studies. I have been extremely lucky to have supervisors who cared so much about me and my work.

Numerous individuals have offered their time, knowledge and resources to help ensure the success of this project. The helpfulness and kindness of these individuals showed the importance of sharing knowledge in this PhD. I would like to thank Leigh Holloway, who shared a wealth of experience that informed this research. I would like to thank Martin Townsend for all the discussions, for being so generous with materials and information, and for the encouragement. A great thanks to all the participants in this study for not saying no, and for sharing their experiences and helping in producing this piece of work.

Much appreciation for Shafiaa Rafeah, Manish Singh, Ekele Ochedi, Phoenix and Maysaa Habibah for the encouragement, support and friendship. Many thanks to all my research students and colleagues with whom I shared this journey for three years – thanks for your friendship and care.

Great thanks to my parents for your constant support, love, patience and understanding. I cannot thank you enough for your prayers; I will forever remain indebted to you for giving me everything you have. Many thanks to my brother and sisters for their support and encouragement. Finally, would like to say thanks to everyone who supported me over the course of my PhD that I have not been able to mention here.

Table of Contents

List of Figures

List of Tables

Abbreviations

Abbreviation	Explanation
AA	Automobile Association
ADA	American with disabilities act
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
CRI	The Carpet and Rug Institute
EPA	Environmental Protection Agency
GUT	Gemeinschaft Umweltfreundlicher Teppichboden
IAQ	Indoor Air Quality
IEA	The International Energy Agency
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LEED	Leadership in Energy and Environmental Design
MCS	multiple chemical sensitivity
NTBs	The National Tourist Boards
RAC	Royal Auto Mobile Club
SD	Sustainable Development
UK	United Kingdom
VOC	Volatile Organic Compounds

CHAPTER 1

Chapter 1: Introduction and Research Context

1.1 Introduction to chapter

The compatibility and relationship between luxury and sustainability relating to material finishes of high-end hotel guestrooms is the main issue being investigated in this research. This chapter provides an insight into the research background in section 1.2; then introduces the research problem in section 1.3. Section 1.4 outlines the research aims, objectives and questions in relation to the identified research problem. Section 1.5 frames the research scope and section 1.6 then presents the adopted research methodology. The research hypothesis is presented in section 1.7 and finally, the thesis structure in section 1.8.

1.2 Research background (luxury)

The building industry has a significant impact on the environment and consumes a great deal of energy, water and materials (Akadiri, et al., 2012). ‘‘Buildings account for up to 30% of global greenhouse gas emissions. They are the main source of carbon dioxide emissions in the developed world, producing almost half of world emissions. For example, buildings create 30% of the US’s total greenhouse gas emissions and half of the UK’s carbon emissions’’ (Moxon, 2012, p. 13) . Additionally, buildings use 20% of global materials: in Europe, construction deplete natural materials more than other industrial sectors. In the UK, the construction industry consumes 350 million tonnes of materials every year (Winchip, 2007). Sustainable development evolved into the main global issue, in response to concerns over greenhouse emissions, and has been defined by research

groups and organisations from various disciplines and perspectives (Moxon, 2012). This wide concept came as a result of climate change (or, as it is sometimes called, 'global warming'), which is mainly a result of human actions producing greenhouse emissions (Moxon, 2012). Sustainability is a significant concern for the building industry, with environmental organisations seeking suitable strategies to make buildings more sustainable (Akadiri, et al., 2012). One such example is the UK's Building Research Establishment for Environmental Assessment Method (BREEAM) – the first building certification scheme in the world (BRE, 2012).

The environmental impact of a building does not only affect the environment, but also the health, well-being and quality of life of its occupants. As reported by the US Environmental Protection Agency (EPA), ''nearly one-third of all buildings suffer from 'sick building' syndrome'' (Mendler, et al., 2005, p. 2) due to poor indoor air quality. There are also several studies that link healthy buildings to a better work productivity, and these issues have increased the demand for solutions (Mendler, et al., 2005). Moxon (2012) notes that sustainable design has developed as a guiding model in the formation of a different kind of built environment: one that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (Moxon, 2012, p. 24). Sustainable interior design was described by Kang and Guerin (2009) as a three-dimensional practice that covers; internal materials, indoor environmental quality and global sustainable interior design. Indoor environmental quality is the most critical concern in the sustainability of interior environments. Enhancing indoor air quality depends mainly on decreasing indoor pollutants, developing thermal comfort and quality interior lighting. Utilizing recyclable materials also supports sustainability. The vast majority of educators and practitioners concur that the interior design profession has a social and moral responsibility to help protect our planet and the health, safety and welfare of people; recently, this ethos has become even more critical because of concerns relating to global warming (Winchip, 2007).

The hotel industry has started to pursue sustainability and is the latest sector in building industry to do so, but this is only for the sake of the industry's economic and financial efficiency, and to satisfy personal ethics by putting sustainability practices into their operational procedures. The trend towards green hotels not only addresses environmental concerns by saving energy, water and resources, but is also expected to improve guest satisfaction and comfort. In hotels which seek sustainability, there is always a conflict between the comfort and satisfaction of hotel guests and green building practices. While hoteliers tend to follow the sustainability trend by saving water, energy and resources, they are limited in their ability to improve the comfort and satisfaction of guests, especially in luxury hotels which focus on big spaces, glamorous materials and lighting that feels warm and inviting. Conversely, the idea of green building focuses on saving and reducing water and energy consumption, as well as smaller spaces (Ahn & Pearce 2013). The prevailing assumption is therefore that sustainable hotels are unattractive and uncomfortable (Mclennan, 2004).

The hotel industry is growing rapidly, and luxury hotel numbers are increasing due to the increase of luxury services and products affecting the tourism market, with more travellers choosing to stay in luxury hotels as a result of the growth in income in the US and Europe. In 2007, 25 million trips were accredited to luxury travel, with an average spend of between €7,000 and €14,000 per trip (Kiessling, et al., 2009).

This development of the luxury market has been the focus of specialist and scholarly attention (Tynan, et al., 2010). Many scholars have defined luxury goods and trademarks in different areas, linking them to psychological theories that aim to identify the causes and underlying motivations for the consumption of luxury goods, or to economic theories where luxury was studied and defined in terms of cost (Kapferer & Michaut-Denizeau, 2014). Nevertheless, none of these studies produced a basic or a key definition of luxury (Barnier et al. 2012; Hennigs et al. 2015). Kepferer (2014) and Hennigs et al. (2015) explained that this difficulty in defining luxury arises from its subjective character. Despite

extensive research into the luxury market, only a few studies within the interior design and hotel context have mentioned or defined the term 'luxury', and mostly indirectly: most of the previous studies on luxury have focused on economic, marketing and management aspects. Few studies have been conducted on hotel interior design material finishes in terms of luxury, while all studies related to luxury hotels have focused more on luxury service (Kapferer & Michaut-Denizeau, 2014).

The expansion of the luxury sector and the growth of its audience has placed it under constant criticism for its increased level of resource consumption and contribution to their risk of depletion (Kapferer, 2010). Luxury brands are often looked upon as the largest consumers of resources (Kapferer, 2010), lagging behind in terms of sustainable development (which calls for social equity) while luxury focuses on specific products and consumers. Accordingly, most luxury brands have responded to the demand of sustainability, but without much communication (Kapferer, 2010).

A lot of research work have been done on the subject of luxury with few focused on defining it within the framework of interior design, and very few studies have investigated luxury within the sustainable hotel industry. However, the evaluation of interior materials for the hospitality industry in terms of sustainability, luxury and cost efficiency is a challenging task. A large group of professionals (architects, manufacturers and managers) complained of the absence of rich, complete, reachable data about the selection of sustainable building materials for interior design (Godsey, 2017). Jones (2008) added that the resources available regarding the use of sustainable design practices and the specifications of environmentally responsible materials are mainly focused on building construction materials, and that very few focuses on the interior of such buildings. Moreover, Máté (2009) stated that interior designers agree on the importance of sustainable design, but their choices and actions are often not consistent with their professed lack of confidence in their own knowledge and in the information about sustainability issues provided by suppliers.

In a recent survey of Canadian business travellers, over 40% of respondents stated that the environmental impact of the hotels they stay at was important to them (Richardson, 2016). Hence, designers have an important role helping reduce emissions through design decisions. Interior designers, as they deal with designing and renovating projects, can help by carefully considering the material finishes they select (Moxon, 2012).

BRE has shown that volatile organic compounds (VOCs) released by different interior material finishes and furniture can cause headaches, eye burning and airway irritation, as well as tiredness (Winchip, 2007). Emissions of VOCs from flooring materials have attracted special interest because usually flooring materials (e.g. carpets) occupy large areas and consist of layers made of different materials (Godsey, 2017). Therefore, most practitioners and educators agree that interior designers have a social and moral responsibility towards the health and well-being of people as well as towards our planet (Winchip, 2007). Therefore, different assessment methods like BREEAM in the UK and others around the world are being utilised to effectively apply greener building policies (Hayles, 2015). BREEAM, which is administrated by BRE, helps buildings to become more sustainable by producing a 'green guide' to specifications to help buildings attain the rating they are aiming for, starting with A (the best) to E (the worst). Additionally, they have provided the material market industry with an environmental profile scheme that helps manufacturers to get their materials and environmental profiles based on life-cycle assessment (Dutfield, et al., 2011). If designers consider BREEAM categories for sustainable buildings, it is obvious that the design will include a sustainable interior environment. However, BREEAM and other assessment tools unfortunately do not focus on social or cultural aspects of sustainability in interior design practice, where considering the social aspect in sustainable interior design can develop standards in living conditions in the interior environment. Sustainable design should focus on defining healthy social interaction and enhancing quality of life. Moreover, physical materials used in designing interior environments play an important role in sustainability. Every physical feature in design is entrenched in specific meanings, standards and values. In this context, design

components such as lighting, materials and furniture can be vital elements in accomplishing sustainability (Ayalp, 2013).

The aim of this PhD is to explore the extent to which luxury and sustainability can co-exist in the design of high-end hotel guest rooms. fill gaps in the existing literature knowledge and highlight the conflict between luxury and sustainability within the material finishes of high-end hotel guestrooms and provide resources that assist designers in making more informed choices regarding luxury interior finishes within the high-end hotel industry. The major focus of this research is to produce a design guide to assist designers selecting luxury sustainable material finishes for high-end hotel guestrooms, carpet as a case study.

1.3 Research problem

Kiessling et al. (2009) states that in the UK, the consumption of luxury products is 50% greater than it was in 1994 and 2004, driven by the growth in incomes in the US and Europe. In 2007, around 25 million trips were accredited to luxury travel (Kiessling, et al., 2009). This significant development in the luxury market encouraged scholars to investigate (Tynan, et al., 2010). Many scholars tried to define luxury, but none of them have put forward a basic definition, perhaps because of its subjective character and dependence on consumer needs and experiences (Barnier et al. 2012; Hennigs et al. 2015; Yang & Mattila 2016).

Luxury hotel owners started to adopt sustainable practices and to be environmentally responsible only for financial benefit (Ahn & Pearce, 2013). In sustainable hotels there is always a conflict between the comfort and satisfaction of hotel guests and the hotel's sustainability practices, where hotel owners focus on operational procedures (like saving water, energy and resources) to be environmentally friendly (Ahn & Pearce, 2013). Many luxury hospitality professionals lack a good understanding of how sustainability and luxury fit together and how these decisions affect the indoor environment, and consequently

hotel guests (Mclennan, 2004). The design, style, comfort and well-being of a hotel's built environment affects the guests' selection of the hotel (Heide & Grønhaug, 2009).

Bohdanowicz and Martinac (2016) pointed out that the widespread belief that environmental measures are excessively expensive is preventing hotels from becoming more 'green'. Additionally, sustainable design is usually assumed not to be alluring and comfortable (Mclennan, 2004). On the other hand, the interior design profession has restricted itself to one-dimensional practice, where interior designers focus more on aesthetic improvements to an interior space (Hayles, 2015). Likewise, Yang et al. (2011) confirm that interior design is so traditional that interior designers ignore energy savings and emissions reductions – which impact on occupants' mental and physical health – instead focusing more on luxury design.

Máté (2006) noted that designers agree on the importance and value of sustainable design, but they do not reflect this in their design choices due to their lack of knowledge and information about sustainability issues. They also do not tend to select sustainable materials unless the client specifically ask for them. Moreover, most of the available resources about sustainable materials are focused on construction materials rather than interior design materials (Jones, 2008). Godsey (2008) added that a large group of architects, specifiers and managers complained of the shortage of rich, comprehensive and accessible data to aid the selection of sustainable interior design materials.

UK buildings produce 30% of total greenhouse gas emissions and half of UK carbon emissions (WinchipP, 2007). Buildings account for 20% of the use of global materials. In the UK, buildings consume 350 million tonnes of materials each year (Winchip, 2007). The building industry has a significant impact on the environment and consumes so much of our energy, water and materials. Thus, sustainability is the biggest concern for the building industry, with environmental organisations targeting suitable strategies to make buildings more sustainable (Akadiri, et al., 2012).

BRE has reported that different material finishes and furniture in the indoor environment release VOCs and causes headaches, eye and airway irritation, and fatigue. Godsey (2017) added that VOC emissions can also cause coordination problems, nausea, liver damage, and damage to the kidneys and central nervous system. Emissions from flooring materials like carpets are of special interest because they occupy large areas and consist of layers made from different materials. Emissions factors may vary significantly, depending on the type of carpet. Until now, no guidelines exist at the European level that regulate the maximum permissible emissions of the total or individual VOCs from carpets.

Although BRE noted that different material finishes and furniture release VOCs, they still do not cover all material finishes in their environmental profiles. Also, BREEAM and other assessment tools do not provide insight into the social or cultural aspects of sustainability in interior design practice, focusing only on scientific measurements and statistics without including healthy social interactions and the enhancement of quality of life (Ayalp, 2013). Moreover, BRE and BREEAM do not focus on the hotel industry, especially the luxury (appearance) aspect of materials, which affect interior designers' choices in designing sustainably. They also do not address designers' lack of sustainable material knowledge.

From the above concerns (which are identified in detail in the literature review), we can see that the subjective nature of luxury and the objective nature of sustainability has led to a conflict, especially within the luxury hotel industry. Additionally, the lack of knowledge among designers and hotel managers and the shortage of complete, rich and accessible data on sustainable material finishes suggests the urgent need for data on material finishes that combines luxury and sustainability, where the researcher is aiming to develop a design guide to assist designers in selecting luxury sustainable material finishes for high-end hotel guestrooms, focusing on carpets.

1.4 Aims, Objectives and research questions

The research questions of this study are informed by the literature review in Chapter 2. The research questions are:

1- To what extent can sustainability coexist with luxury hospitality?
2- What are the barriers to sustainability in material choices for luxury hotels?
3- Can design guidance support an improved alignment between sustainability and luxury?

The main aim of this research is to explore the extent to which luxury and sustainability can co-exist in the design of high-end hotel guest rooms using carpet as a case study.

The key research objectives are:

1- To review the hospitality and design literatures and establish the relationship between luxury and sustainability.
2- To identify the main design attributes for materials in luxury hotels.
3- To undertake a mixed methods study of design decisions relating to carpets in luxury hotels.
4- To undertake a case study of a luxury hotel in London.
5- To generate a design guide for decisions relating to carpeting in luxury hotels.

1.5 Scope of the research

This research focuses on a design guide to combine luxury with sustainability for material finishes for high-end hotel guestrooms. The scope of this research changed dramatically from Asia to Europe: the researcher originally intended to undertake research in Amman, Jordan where luxury hotels are on the increase (this is explained in detail in Chapter 3) but

for security reasons, luxury hotels in Amman refused to cooperate and participate in the research as case studies that would include having access to hotel rooms and interviewing hotel managers. After searching for five-star hotels in the cities of Leicester, Nottingham and Birmingham (none of which have five-star hotels), the scope therefore moved to and centred on London. Clearly, London was the most suitable area to conduct the research, possessing many national and international chain and independent five-star hotels. London is also a destination for millions of tourists from all over the world. Furthermore, London was chosen as it leads in sustainability and holds conferences, exhibitions and summits on sustainability. Additionally, most famous sustainable manufacturers' offices and famous international hospitality design offices are based in London.

The conflict between the subjectivity of luxury and the objectivity of sustainability within the material finishes of hotel buildings and the aim to produce a design guide to assist designers selecting luxury sustainable material finishes for high-end hotel guestrooms was beyond the researcher's ability and timeframe for this study. Thus, the researcher chose to focus on flooring material finishes, and specifically carpets, which have a universal application (i.e. they can be use in retail, residential or commercial environments). Additionally, carpets are mandatory in most of five-star hotels. Moreover, Godsey (2017) noted that emissions of VOCs from flooring materials have drawn special attention because frequently flooring materials like carpets occupy huge spaces and consist of layers composed of various substances (see Figure 1-1).

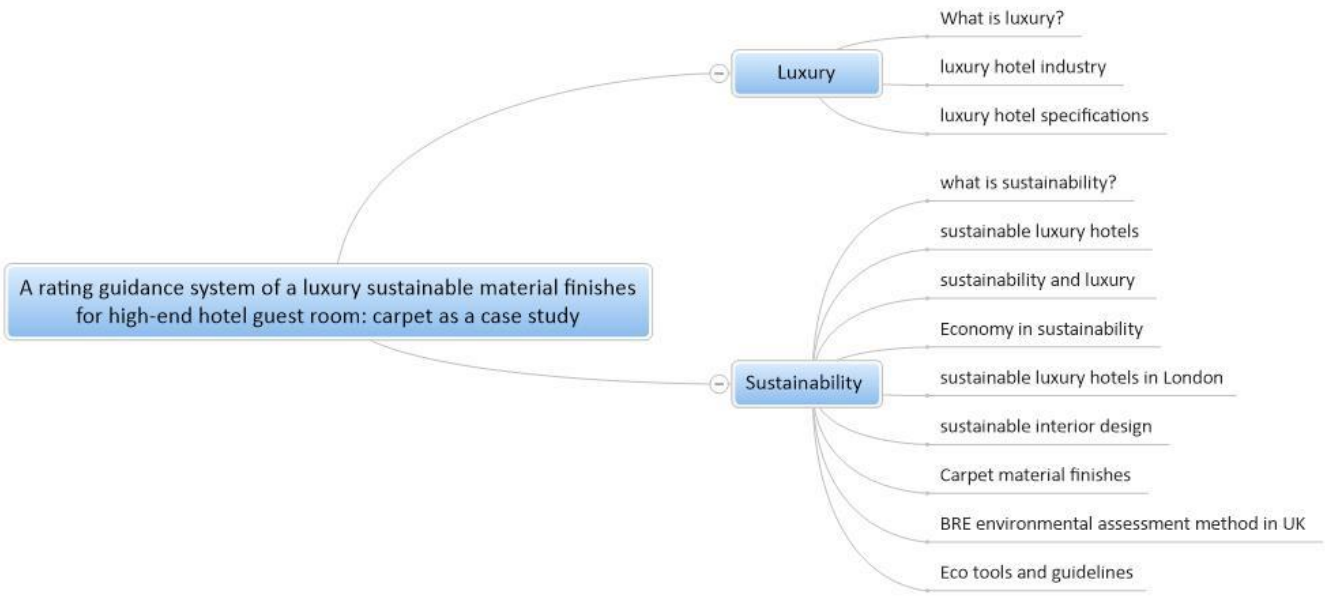


Figure 1-1 Research scope and mind map. Source: author.

1.6 Adopted research methodology

As mentioned in section 1.5, the research scope moved from Amman to London due to the challenges experienced in gaining access to potential case study materials. Therefore, a specific methodology was developed for hotels in London (see Figure 1-2).

As in any research, there are some limitations. Using London had some limitations; (mentioned in section 6.9). One of these limitations was the struggle to interview designers based in London, where big design firms operate according to busy schedules. In addition, there were difficulties in interviewing luxury hotel guests in London, where hotel owners refused to participate to protect the privacy of their guests. Accordingly, the researcher added a new method to collect more designers' and hotel guests' views without consuming as much of their time by sending them online questionnaires (discussed in detail in Chapter 3). Thus, the research project's methodological approach moved from qualitative to mixed-methods.

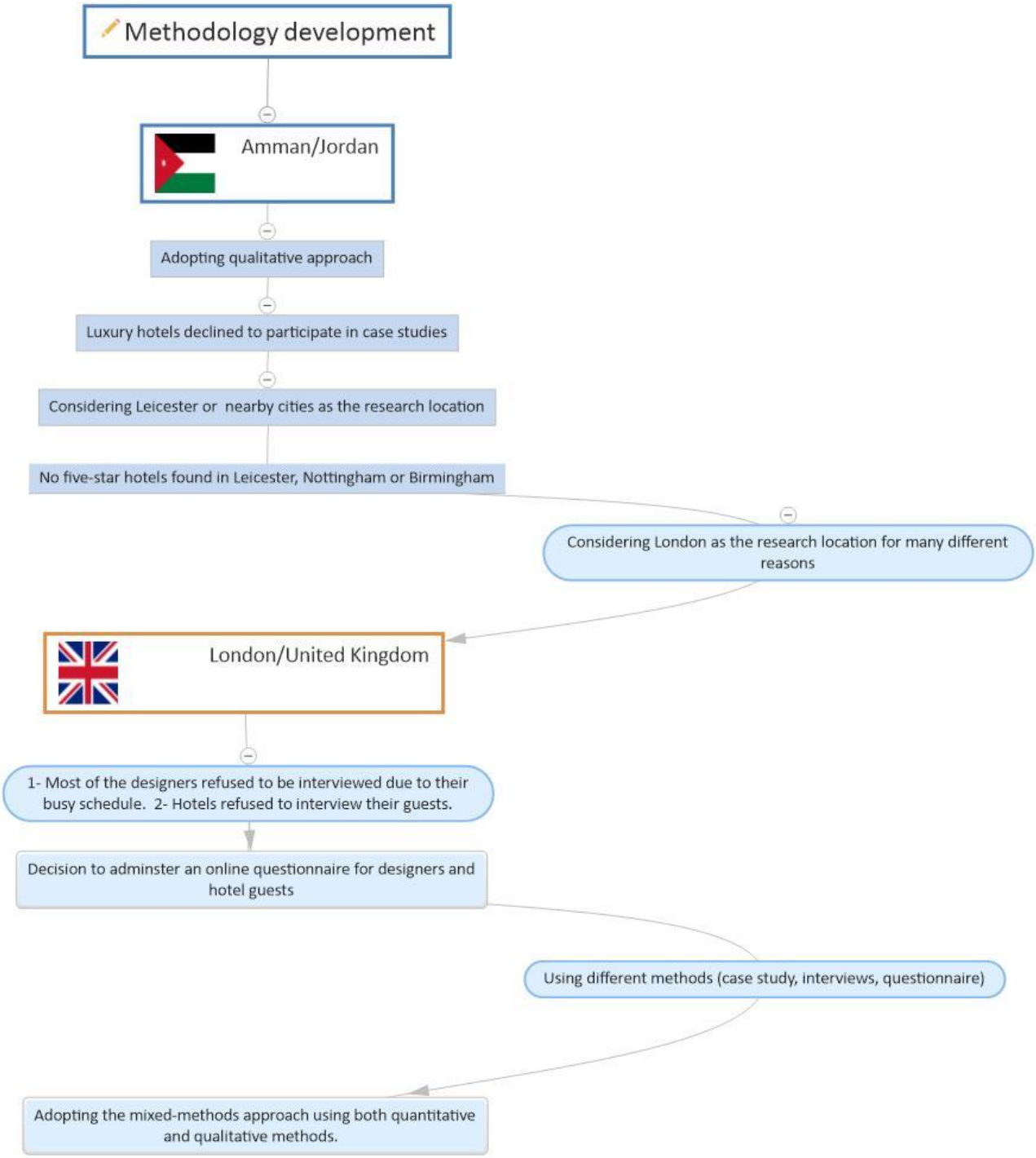


Figure 1-2 Research methodology development. Source: author.

.

Methodology is the engine of academic research. According to Seals (2004) research methodology deals with the theoretical and philosophical consequences of choosing a research method. Additionally, any research project is directed by a set of assumptions that are generally known as paradigms (Killam, 2003). This research adopts a pragmatic worldview which allows for the adoption of quantitative and qualitative approaches (Saunders et al., 2009). The topic of this research covers a varied range of aspects of relevant material obtained through the literature review. Therefore, to answer the research questions and cover the various aspects of the research, and to respond within the limitations mentioned above, there is a need to undertake a holistic approach. Consequently, the researcher chose the mixed-methods approach, using a quantitative designers and hotel guests' questionnaire combined with qualitative methods including case study and semi-structured interviews with designers, hotel managers, manufacturers and BREEAM directors. The research is divided into three stages (see Figure 1-3), with each stage interlinked. The first stage is undertaking the case study about luxury hotel guestrooms, via visual inspection of the carpets and gathering data about the current situation of luxury hotels and sustainability by interviewing hotel managers, designers, manufacturers and BREEAM directors, at the same time as collecting data through a questionnaire targeting designers and another to gather information from luxury hotel guests. This helped to inform the second stage of the research. The second stage is testing the carpet samples collected from both rated and non-rated BRE manufacturers to investigate the preferred luxury carpet specifications. This informed the third stage – developing and evaluating a guidance rating system for luxury sustainable carpets (see Figure 1-4 for the methods, tasks and phases along the research project timeline). An in-depth explanation of each method is described and justified in Chapter 3.

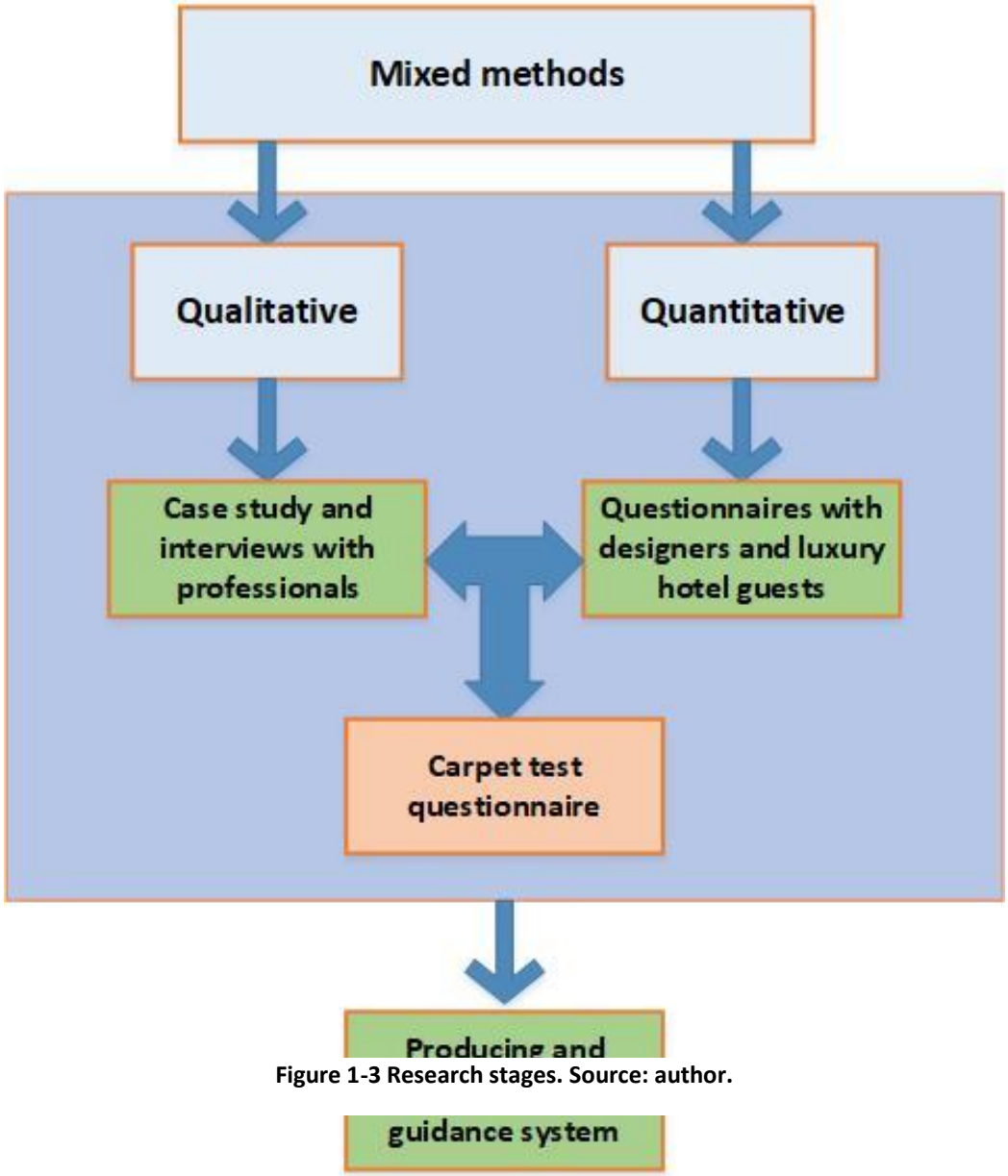


Figure 1-3 Research stages. Source: author.

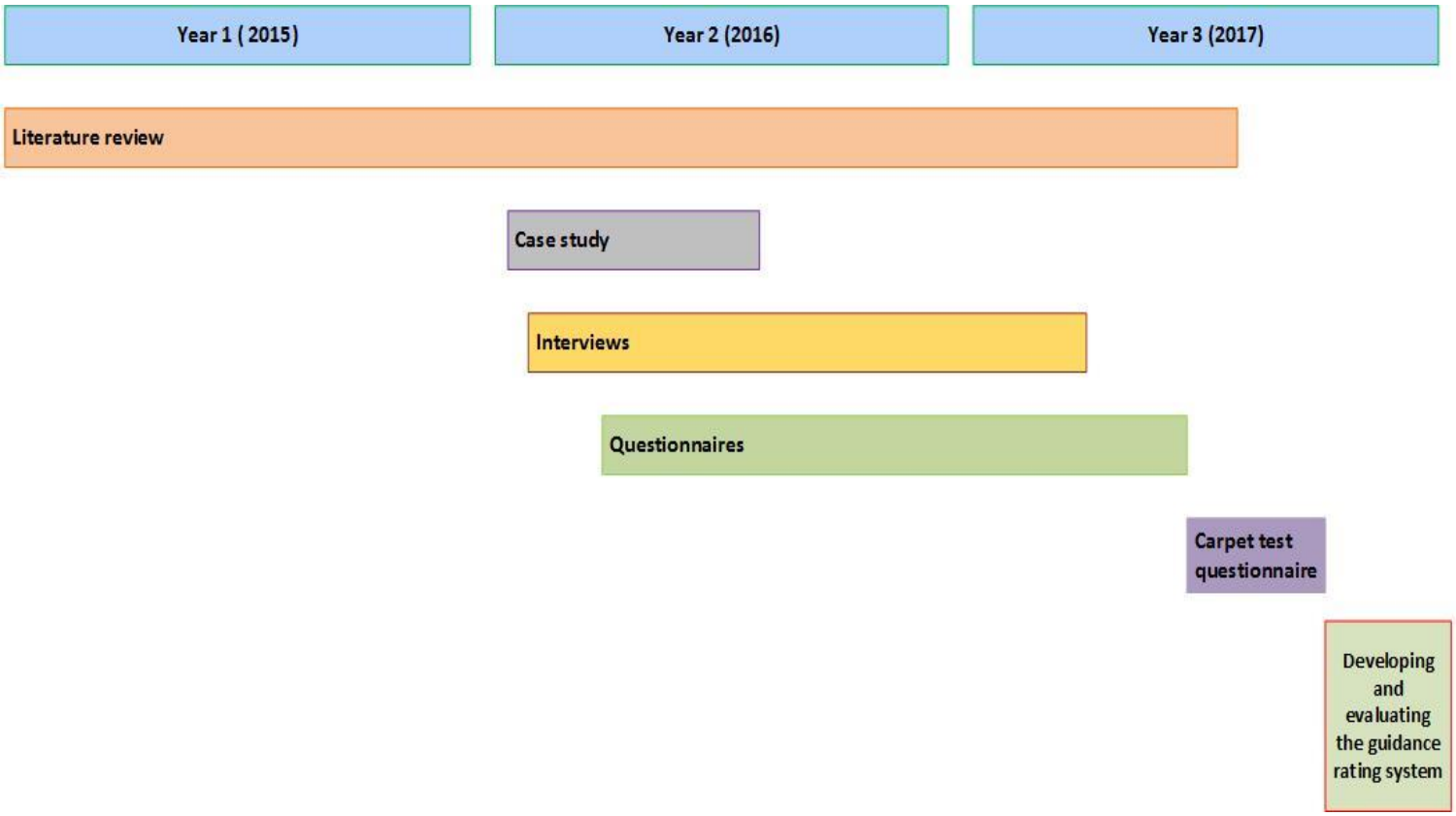


Figure 1-4 Methods, tasks and phases through the research project timeline. Source: author.

1.7 Thesis structure

Chapter 2 provides an overview of previous studies on luxury, sustainability, the luxury hotel industry, material finishes, BRE and BREEAM.

Chapter 3 explains the research methodology, covering the research philosophy and paradigm, an overview of research methods (quantitative, qualitative, mixed-methods), advocates for a mixed-methods approach, and provides a methodological and data collection framework.

Chapter 4 presents the data results, including findings from interviews, the case study, questionnaires and the test questionnaire.

Chapter 5 shows the development of the design guide by covering the rationale for the development of the design guide, an overview of guidelines, the proposed development stages and an evaluation.

Chapter 6 presents the discussion by outlining the main findings from the primary data in relation to the findings from the secondary data and the research conclusion. It reviews the outcomes in relation to the research aim and objectives, the summary of findings, the research's contribution to new knowledge, opportunities for future research, limitations and concluding comments.

Figure 1-5 present the above thesis structure visually.

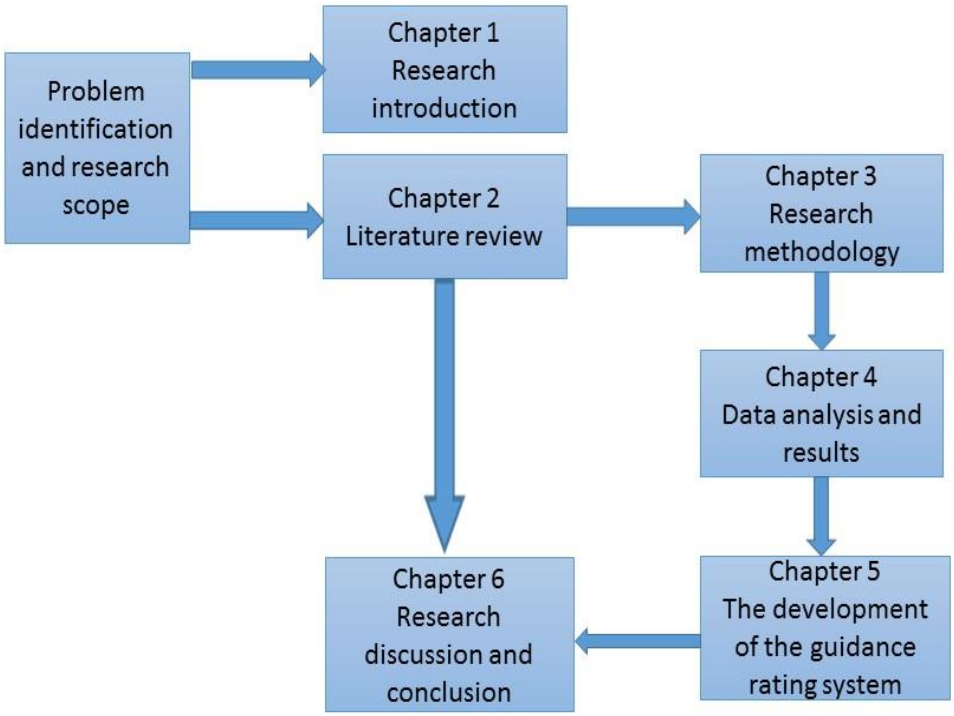


Figure 1-5 Thesis structure. Source: author.

1.8 Summary of chapter

This chapter presented an overview of the research undertaken by providing an introduction followed by the research problem, research aim, objectives and questions, and a summary of the methodology used. Furthermore, the chapter presented the research scope and the location for field research, undertaken in London. Finally, it concluded with a summary of the thesis structure.

CHAPTER 2

Chapter 2: Background and Review of Literature

2.1 CHAPTER INTRODUCTION

This chapter presents background information based on existing literature on luxury, sustainability and the relationship between luxury and sustainability within high-end hotel interior design material finishes. In so doing, the chapter focuses on the topics related to the research questions presented in Chapter 1, section 1.4. Section 2.2 reviews the history of luxury, definitions of luxury and aspects of luxury. Furthermore, section 2.3 gives an overview of the foundation of the luxury hotel industry, specifications and the specifications of luxury hotel guest rooms. Section 2.4 discusses the relation between luxury and sustainability by focusing on sustainability definitions, life cycle analysis (LCA), sustainable design for the built environment, sustainable interior design and sustainable flooring materials. Additionally, this section discusses sustainability within the hotel industry, environmental assessment methods used for buildings within the UK, BREEAM (the Building Research Establishment Environmental Assessment Method) as the main focus, and luxury and sustainability within high-end hotels. This chapter concludes with a summary in section 2.6.

2.2 Luxury

Kiessling et al. (2009) state that over the past few years, exceptional demand for luxury services and products has arisen following the growth of income across U.S and Europe. The luxury division has been one of the quickest developing markets as of late. Over the past two decades, the global luxury market has grown rapidly. It was estimated to be worth $263 billion in 2007, largely fuelled by demand from rising economies.

In Great Britain, customer spending on luxury products is 50% greater than it was in the years between 1994 and 2004. This in turn has positively affected the luxury tourism

market, with more individuals choosing to stay in luxury accommodation. In 2007, nearly 25 million journeys annually were associated with luxury travel, with an average spend of between €7,000 and €14,000 per trip (Kiessling, et al., 2009).

This remarkable development of the luxury market and its associated difficulties have meant that specialists and scholars frequently examine and investigate the luxury market. (Tynan, et al., 2010).

2.2.1 Historical and etymological context of the term 'luxury'

Dubois et al. (2005) note that in Oxford Dictionary (1992), the term 'luxury' is derived from the Latin word 'luxus', which implies "soft or extravagant living, (over-)indulgence" and "sumptuousness, luxuriousness, opulence". Luxury has frequently been related to exclusiveness, prestige and superiority (Atwal & Williams, 2009).

According to Kunz (2003), the word 'luxury' obtained its current meaning of exclusivity, opulence, extravagance and excessiveness in the 17th century. During the 18th century, Britons and Americans utilised the word 'comfort' with increasing frequency to express their fulfilment and happiness with their immediate physical surroundings. This utilisation implied a wish to reject conventional material culture and to enhance it. The notion of solace drew the consideration of political financial specialists, moral thinkers, researchers, philanthropic reformers, and even authors. These individuals gave the term 'comfort' a further physical accentuation as they reconceptualised values, overhauled material conditions, and encouraged the relearning of practices. For a considerable length of time, 'comfort' had already essentially implied moral, passionate, profound and political help in troublesome conditions. To be 'desolate' had implied being 'without anything to ease incident', and 'uneasiness' included sentiments of 'distress', 'despairing' and 'unhappiness' as opposed to physical disturbance. Dialect writing and ideas stressing the physical significance of solace first grew during the beginning political economy around 1700, as it investigated the contrasts between luxury and need. Luxury had for quite some time been the subject of political and social ideas, yet it was characterised by an antonym,

'need', which had been underestimated as having a characteristic definition. Luxury was what individuals wanted beyond necessities (Berg & Eger, 2003).

Hilton (2004, p.118) notes that in the 19th century, "anti-modernist ideals resulted in a cross-section of cultural and intellectual elites condemning the cheap luxuries of the mass market", thereby outlining the obstruction of the era against this democratisation of luxury and towards more selective, high-class standards, Addressed over a century ago, Thornstein Veblen's Theory of the Leisure Class (Veblen, 1899) discussed in more detail below, presents an influential model of conspicuous consumption, hypothesising that individuals follow the consumption patterns of those individuals at a higher point in the hierarchy. This hypothesis of conspicuous consumption is augmented in Hilton's earlier findings – the 'intellectual elites' denouncing the democratisation of luxury, while concurrently the lower classes try to achieve a higher status in the social hierarchy.

In the 20th century, the demand for and production of luxury products increased, while many brands boosted their growth by developing and extending their brands; for example, the Armani brand developed and extended its brand into a hotel chain (Tungate, 2009). See figure 2-1.

Figure 2-1 Armani hotel, Dubai, United Arab Emirates, one of the fashion-branded hotels. Source: https://www.booking.com/hotel/ae/armani-dubai.en-gb.html

Tungate (2009) notes that in the 21st century with the democratisation of luxury, the definition has evolved from one where luxury is "selective and exclusive" to a new conceptualisation of luxury which still has an emphasis sophistication but whose selectivity is less obvious. Two kinds of luxury have emerged: inaccessible luxury and mass luxury, enabling consumers to enjoy and access luxury products at lower prices.

A number of scholars have defined luxury goods and trademarks in different fields including history, psychology, marketing, consumer behaviour and business, linked to psychological theories attempting to recognise the causes underlying motivation for consuming luxury goods, or economic theories where luxury was defined in terms of cost (Kapferer & Michaut-Denizeau, 2014).

Additionally, Barnier et al. (2012) and Hennigs et al. (2015) state that none of these studies have put forward a key definition of luxury. On the contrary, Yang and Mattila (2016) state that there is no approved definition of luxury and that marketers use the term 'luxury' to persuade consumers to pay a premium price. They argue that the

difficulty in defining and measuring luxury arises from its subjective character; where "normal" ends and "luxury" begins is judged by the individual.

Kapfere (2014) and Hennigs et al. (2015) emphasise the subjective nature of the luxury definition, and that it depends on consumers' needs and their experience. They add that luxury refers to indulgence objects, the notion of being unique, and goes beyond people's needs in life. Hence, luxury objects or experiences are mostly affordable for consumers with superfluous money.

On the other hand, Barnier et al. (2012) argue that luxury products or experiences might be a necessity in one society while being ordinary in another. Despite this, they argue that studies have reached a consensus on the point that luxury products satisfy both functional and psychological needs. Similarly, Bilhuber (2008) states that luxury is part of what makes us human, that it brings us pleasure and pride. He adds that luxury is the opposite of vulgarity and is completely surprising.

2.2.2 Luxury aspects, values, and general theories

Line and Hanks (2015) argue that luxury products attract consumers through two crucial aspects: the tangible and intangible. These two aspects define the consumer purchase intentions of luxury products, and in these two aspects are hidden three values according to which consumers consume luxury products: hedonic, symbolic, and financial values, explained in the following:

1- Hedonic value

- This is where the expressive profit such as extravagance and enjoyment is the level to which a product produces a delightful experience and pleasure for the user. The argument is that consumers buy and use luxury products not only for their practical worth but also for immaterial values such as sensual satisfaction.

2- Symbolic/expressive value

Symbolic expressive value implies that the user treasures the psychological aspect of a product, and that consumers use luxury products to show off their prosperity and strength. They tend to consume high-price products to symbolise status. The expressive value of luxury is mostly found within tangible goods rather than intangible ones. For instance, in the hospitality services the intangible services provided are usually invisible.

3- Financial value

Price can affect the consumption of luxury goods both positively and negatively. Many luxury users consume luxury products to signify their wealth power, while others correlate expensive goods with superiority.

(Line & Hanks, 2015)

Maybe the most intense argument associated with luxury is about necessity versus luxury. As Kapfere (2015), Hennigs et al. (2015) and Yang and Mattila (2016) highlight that luxury is subjective and depends on users' needs and experiences. Similarly, Barnier et al. (2012) state that what can be luxury for one person might be normal for another.

As Thomas (2008, p. 17) mentions in his book, "luxury is a necessity that begins where necessity ends" (Coco Chanel).

Recently, a 'new luxury' term has emerged, referring to products which involve users' emotions while nurturing their ambitions for a better life (Silverstein & Fiske, 2003). The concept of 'trading-up' or what was previously called 'new luxury' has grown in recent times (Kiessling et al., 2009), with alternate trademarks referred to as the 'luxurification of society' and 'democratisation of luxury' being formed to define a new type of luxury for the middle-market consumers with desire for goods which meet their requirements but less expensive (Atwal & Williams, 2009). There is also arguably an ambition to consume

products that will help in lift up their position on the social hierarchy, as mentioned previously by Line and Hanks (2015) in their discussion of luxury values.

As mentioned above, Veblen (1899) set the basic definition for conspicuous consumption in his book *The Theory of the Leisure Class*. In this work, his theory assign to the public consumption of products and services as a way of gaining fame, esteem or status amid social classes. Elliott and Urry (2010) and Beaverstock et al. (2011) adopted Veblen's (1899) theory of the leisure class by studying it and applying it to the concept of the 'Global Elites'.

For some, status is achieved purely through price, with premium price granting the consumer a better level of status and esteem. Husic and Cicic (2009) reference the three categories established by Vigneron and Johnson (1999), containing the 'snob', 'bandwagon' or 'Veblen' outcomes. They describe them as follows; see Table 2-1:

Veblenian Consumers	**Great attention to price as a pointer of their status, because their main aim is to amaze others.**
Bandwagon Consumers	Less attention to price, but consuming prestigious brands to impress others.
Snob Consumers	See cost as a marker of exclusivity, and abstain from utilising well-known brands to explore different avenues regarding internal coordinated consumption.

TABLE 2-1: LUXURY CONSUMER CATEGORIES DEVELOPED BY VIGNERON AND JOHNSON (1999).

Kapferer (2014) emphasises that "luxury is based on rarity". In addition, Phau and Prendergast (2000) highlight the rarity principle by stating that brands should maintain

and enhance their exclusivity and rarity in order to maintain status and prestige. Suggestions for the luxury hotel industry can be made, whereby those hotel brands which market themselves as unique and exclusive may be well placed to develop Phau and Pendergast's (2000) notion of 'Dream Value', in turn expanding demand. There is evidence of luxury hotels advancing the individuality of their brand.

Through examining the past studies on luxury, it is evident that luxury consumers purchase luxury products or services to feed their sensual drivers such as emotional pleasure and self-gratification (Wiedmann, et al., 2007; Line & Hanks, 2015). None of the researchers have agreed on a basic definition of luxury, but they have agreed on some principles and concepts. Kapferer (2010) states that luxury is criticised for the focus on certain products and consumers, the waste of resources, and luxury brands being very slow in following the sustainability trend. However, in his analysis, Kapferer (2010) revealed that luxury and sustainability both focus on rarity and beauty, as will be explained in detail in section 2.4.

2.2.3 The luxury hotel industry

The term 'luxury' has transformed to cover a range of meanings and explanations throughout history. Luxury has been open to a numeral of stimuli, and the influence these have on shaping the behaviour and communications of users and consumption experiences must be provided reasonable attention. Little research has been conducted on luxury hotels or luxury hotel interior design, and as such, the perceptions that follow are mainly drawn from the marketing, management and philosophy literature.

According to Ahn and Pearce (2013), 'hotel' is an American term taken from the French term 'hôtel', which dates back to the 1760s, referring to a "nobleman's residence, large official building, or town hall". As Watson (2005) describes, the origin of hotel culture stretches back to a time before the first permanent structures. In many ways, it began

with the tent: purpose-designed accommodation providing shelter in a temporary location. The tent has entered a new era of design vogue, related to the explosion in eco-tourism, where the avoidance of permanent structures helps to maintain delicate natural environments.

Similar to the tent, the stable hotel building was constructed as a reaction to human mobility. The signposts of that mobility – ports, railways, highways, trading posts – all played a hugely important role in the founding of the modern hotel. British hotel culture, which dates back to ancient times, grew up along the main roadways between cities, with inns providing resting points for travellers and horses. The taverns and hotels of the east coast of America met the demands of the huge waves of immigration of those seeking to carve out a future in the Promised Land (Watson, 2005).

The burgeoning of cities in the industrialised West gave rise to huge mobility of labour and thus a new momentum for the urban hotel, helped by the introduction of rail networks. Hotels continue to cluster around railway stations, which is an enduring reminder of the role of the hotel as a provider of temporary accommodation for those on an economic rather than leisure trip and where a quick exit is more important than becoming engaged in the cultural heart of the city. It took a surprisingly long time for hotels to take on the mantle of purveyors of luxury for leisure time (Watson, 2005).

2.2.4 Foundation of luxury hotels

The 19th century saw a shift towards travel purely for the sake of aesthetics and culture. The Industrial Revolution, with its creation of a wealthy middle class, mobility of labour and advanced travel networks, opened up the idea of cultural travel to a more significant number of people than the small number of aristocrats who would head off on a grand tour. This brought about a shift in the understanding of the role of the hotel. It was customary for the aristocratic classes of Europe, who were always more mobile than the poorer classes before the Industrial Revolution, to stay as the guest of another aristocratic family or to lease private houses if they did not have their own metropolitan residence.

Entertainment was also largely private, taking the form of soirees, dinners, balls and visits to private clubs, which were based upon the interiors of domestic residence. In broad terms, although it did appeal to the upper echelons, the grand hotel was a social innovation that met the needs of a new, affluent middle class which was creating the modern concept of refined public leisure and tourism. Although the Industrial Revolution began in Britain towards the end of the 18th century, the finest example of its effect on hotel culture, and its connection to contemporary concepts of luxury, can be found in the United States (Watson, 2005).

Moreover, Watson (2005) argues that luxury was linked to innovation, a neo-classical exterior, spacious, high-ceilinged communal spaces, excellent upholstery, and complementary toiletries. However, some of the most-loved luxuries were recent innovations such as plumbing and a simple prototype of the telephone that guests could use to contact reception. In addition, people valued having keys to their rooms, giving them the independence to come and go as they pleased. These were the seeds for a respect for individualism that has become a mainstay of hotel culture and is connected to the burgeoning, anti-homogenous design concepts that snowballed during the 'boutique' years.

Grand hotel culture reached Europe later in the 19th century, with the Savoy opening in London in 1898. Innovative architecture and design could be found within the purveyance of luxury (Watson, 2005).

According to Kuns (2003), luxury hotels are a great challenge to the management and staff, on the one hand, and of course to the architects and designers on the other. They must understand the performance terms for a smoothly operating luxury hotel and achieve them in such a way that the relationship to the site, its materials, colours and forms can be recognised as classifying parameters and delivered with the highest level of craftsmanship and design.

Thus, architecture sets the backdrop for the reception, relaxing, pampering, enjoyment, lounging, and communication to counter one's hectic, daily routine. Individuals can unwind, recover their energy, and experience fascination with luxury. In this regard, luxury hotels are accommodation of the most comfortable kind. It is worthwhile distinguishing between those that follow formal criteria to solely create a piece of service real estate, and those that have subscribed to the goal of "true luxury" (Kunz, 2003).

2.2.5 Luxury hotel specifications

Kunz (2003) defines a luxury hotel as a hotel that suggests a certain element of dreaming. On the other hand, Ahn and Pearce (2013) describe a luxury hotel as spacious, including glamorous materials, with refined lighting that senses warm and inviting, and toilets with a big tub and multiple showerheads (see figure 2-2). This is a hotel or property that is dedicated to comfort, service, space and history, and this typically means high expenses. To ensure maximum return on investment, such hotels require good management. According to the Automobile Association (AA) Hotel Services, in their hotel quality standards, the word luxury is used to describe 'five star' hotels (AA hotel services, 2015). As Callan (1995) explained, hotels in the UK are ranked and rated by different organisations such as the Automobile Association (AA), the National Tourist Boards (NTBs), Royal Automobile Club (RAC) and commercial guides like Egon Ronay and Michelin. The classification is used to sub-divide the standard of accommodation into classifications, for instance, stars (AA and RAC) or crowns (NTBs). Each category entails detailed facilities and services, like the minimum size of guestrooms and presence of a full-length mirror (Callan, 1995). Grading, as described by Callan (1995), is a qualitative assessment used to evaluate how good or bad is the specified facilities or services presented. Results are expressed in different ways depending on the organization; for example, the NTBs use descriptions like "Commended" and "highly commended". These

Design Features	Design Features for Luxury Hotels
Lobby Design	• Social interaction spaces not only for guests but also for the local community • Staged to provide a theatrical introduction to the environment and hotel spaces
Guestroom	• Safety, comfort, privacy, quiet and spacious guestrooms • Unique design details, technology, and controllable lighting • Comfortable indoor environment • Comfortable office spaces within the room • Stylish furniture, plush materials and high tech entertainment devices
Bathroom	• Spacious bathroom • Deep tubs, his and her lavatories, walk-in showers, marble and chrome finishes • Quality and appearance of amenities • Technology such as a small plasma television, flexible lighting
Artwork	• High quality artwork in guestrooms, hallways, lobbies, staircases, and elevators • Gallery areas in the hotel
Spa	• Attention to interior design, increasing guest relaxation • Transition areas and generous public spaces • Multiple relaxation areas: outdoor and indoor • Environmental controls for guest comfort • Spa cuisine-health, organic options
Food & beverage	• Organic food and unusual food items • Top quality food and beverage
Landscaping and exterior environment	• Parks/gardens with trees and plants • Open space with trees and plants • Diverse colors and textures

Figure 2-2 Design features for luxury hotels. Source: Ahn & Pearce (2013)

Quality evaluations add to the classification level to create the end result, such as “three crowns commended” (NTBs) (Callan, 1995).

In the past, design and construction costs were not so significant and those who ventured into luxury properties, apart from their personal riches, had the advantage of cheaper building materials and low labour costs. Unlike in the past, there are now broad design styles that have to be incorporated into luxury hotel designs. Irrespective of whether the luxury property to be built is a huge grandiose destination hotel or a city boutique hotel, any luxury property must have the following fundamental characteristics, if not all, then at least a number of them. (Kunz, 2003) These include:

- Formal public spaces and grandiose lobbies.
- High-level design, excellent materials and high-quality finishes.
- Spacious, fully furnished and tranquil guest rooms with plentiful storage space.
- Bathrooms with multiple fixtures and effective water flow.
- Huge back of the house spaces to facilitate a high-quality guest service.

(Kunz, 2003)

Kunz (2003) argues that the last ten years have seen an increase in private investments in luxurious hotels. The economic growth experienced in America has led to the emergence of a new category of people who move around from place to place and are ready to pay high accommodation costs either for pleasure or business. This type of traveller expects a perfect experience, personalised service and attentive service. The exemplars of luxury hotels were laid out at the start of the 20th century; these early exemplars have provided inspiration to modern-day designers. Recent luxury hotels have been upgraded to meet current technological and telecommunication needs, thereby raising standards in the hotel industry.

Moreover, Kunz (2003) states that according to international standards, a luxury hotel is an enterprise that would be ranked the highest in hotel ratings. In many countries, hotels providing the highest-quality accommodation, services, cuisine and facilities are designated as five-star hotels.

Luxury Hotels are often analogous with landmark structures in popular tourist destinations such as French capital Paris or Europe's Financial Capital London or even the design district of Italy Milan; they entice their affluent guests with services and offerings that are customised to their needs and standards. Design and architecture of these luxury hotels is a symbol of tradition and history, which often depicts a specific period of history, which thus helps in keeping up the luxurious aura of every section in these hotels.

Although, as of late the clientele of these luxury hotels have changed, it is being observed that buyers and influencers in this luxury hotel segment are investing in their properties not just to make them more alluring to the demanding clientele, but also to make them more inviting to the younger and trendier luxury consumer (Kiessling, et al., 2009). As a result, luxury hotel brands and their propagators have discovered approaches to separate their product within the segment. The value or demand of the property is now affected by the type and nature of the physical asset. The impulse behind booking into a luxury hotel is hugely influenced by its location, the overall design/architecture of property, the landscape and the services provided such as room composes, size, eateries, amenities and standard of the spa (Kiessling et al., 2009).

The difference between a luxury hotel and another type of hotel is its dedication to providing guests with above-standard comfort. Luxury hotels are intended to provide their guests with some sort of unique experience, which can either be derived from its exclusive geographical location or its outstanding design. A luxury hotel would be more appealing if it combines both of these aspects. To select the most suitable architectural design, hotel designers need to look beyond the domestic and functional aspects of design. This way the design will be able to provide guests with a feeling of adventure as well as providing excellent services and comfort (Kunz, 2003).

2.2.6 Specification of luxury hotel guest rooms

Usually luxury hotels have more spacious rooms compared to those in other hotel categories. The guest rooms are usually bigger in size because they are designed to have a meeting space, sitting space and bed space; at times the rooms are designed as suites. The rooms are also generally intended to offer maximum comfort to the guests and include additional features like excellent multi-fixture bathrooms, lavish accessories and extra décor as well as high-quality bedding. Other common features of luxury hotel rooms

include spacious closets, desks, vanity goods and household accessories aimed at providing comfort and recreation. Room sizes generally range from 40 m^2 to over 60 m^2.

Additionally, luxury hotels have more king-size rooms than double-queen, double-double or even twin rooms. Also, luxury hotels have more suites than standard rooms, with suites accounting for about 12% to 35% of the hotel rooms. Small boutique hotels offer an all-suite type of accommodation. The finishes and accessories of guest rooms and bathrooms spell out the nature and ambience of luxury hotels because even though the outside of the hotel gives the greatest impression, the guests spend more time in their rooms. Normally guest rooms in luxury hotels are not intended to offer the most efficiency but instead are meant to provide a touch of extravagance, thoroughness and quality. Spacious storage and closets in the guest room assist guests in keeping luggage out of sight. Often bathrooms have stone and marble flooring and wood trims with crown moulding styles. Every fixture is usually classical with a permanent appearance and finish (Watson, 2005).

The guest rooms are a significant component of the visitor's experience. The guestroom in these luxury hotel properties is often built in a bigger scale than the offerings in other hotel segments, offering open rooms to give solace and upgrade the luxurious feel of the visitors' stay and time. Moreover, such properties as a rule centre around suites and hence offer a higher suite ratio. Standard room sizes begin from 30– 40 m2 and can ascend to 60 m2. Suites tend to begin at a bigger size, with illustrious suites be around 150– 175 m2. The measure of the guest's rooms likewise also relies upon location and can't be generalised for every luxury hotel or property. Autonomous of the room size, luxury hotels have begun to offer more in-room comforts and facilities for their visitors/guests to cater to their luxury needs and experience (Kiessling et al., 2009).

- **Summary tableof luxury and luxury hotel definition:**

Luxury	Luxury hotel
Comfort	Spacious
Opulance	Comfortable
Exclusive	Glamorous materials
Unique	High quality finishes
Emotional pleasure	Described as a five-star hotel by AA hotel services
Beauty	Using crowns or stars to rate hotels quality by giving 5 crowns/stars to the luxury hotel

Table 2 Luxury and luxury hotel main definitions. Source: Author.

2.3 Sustainability

Climate change is the most alarming of the ecological concerns we face. It is usually described as 'global warming'. The influence of climate change is felt in all areas of environmental, physical and social wellbeing. Climate change is widely believed to be caused by human actions, such as cutting down trees for timber or agriculture, leaving waste to rot in landfill locations, and burning fossil fuel for energy and transport, which produces excess greenhouse gases, mainly carbon dioxide and methane. As the human population grows, so these activities increase (Moxon, 2012). Climate change is affecting the world in many ways, such as flooding, rising sea levels, increased temperature, etc. Macgilllick (2015) notes that sustainability is about how we share this planet with everyone and everything else over the long term. The owner of every dwelling has a responsibility to contribute to the long-term sustainability of the planet so that this and subsequent generations of human beings can live effective and fulfilling lives. Therefore, there is a need to reduce the amount of CO_2 emissions arising from human activities, and this has led to numerous measurements of emissions (Rotimi, et al., 2017).

According to the International Energy Agency (2011), "world carbon dioxide emissions from the consumption of fossil fuels are expected to grow at an average rate of 2.0 percent per year from 2002 to 2025". The construction industry has an enormous environmental impact on the planet, where ''Buildings account for up to 30% of global greenhouse gas emissions. They are the main source of carbon dioxide emissions in the developed world, producing almost half of world emissions. For example, buildings create 30% of the US's total greenhouse gas emissions and half of the UK's carbon emissions'' (Moxon, 2012, p. 13) . The built environment's impact on resources and biodiversity is equally disturbing. Buildings estimate for 20% of the use of global materials. Building industry in Europe consumes more natural material by weight than any other industrial sector; in the UK, this means an estimation of 350 million tonnes of materials annually

(WINCHIP, 2007). The building sector has a vital impact on the environment and consumes a large amount of energy, water and materials. Thus, in response to these impacts, sustainability is the biggest concern for the building industry, which has responded by making agreements with environmental organisations targeting suitable strategies to make buildings more sustainable (Akadiri et al., 2012).

Among the bold statements that have been made are the assertions that most of the global warming over the last 50 years is attributable to human activities; that human actions will proceed to change the balance of the atmosphere; which means that temperatures and sea levels will remain to rise for many eras to come (Wilby, 2007). Therefore, Kuhlman and Farrington (2010) and Moxon (2012) emphasise that sustainability is the key to safeguarding our earth and our natural resources.

The United Nations World Commission on Environment and Development (1987) defined sustainable development as an approach to “Meet the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development , 1987). the Global Development Research Centre (2008) defines sustainable development as “Maintaining a delicate balance between the human need to improve lifestyle and feeling of wellbeing on one hand and preserving natural resources and ecosystem, on which we and future generations depend” (Global Development Research Center, 2008).

The Environmental Protection Agency (2012) offers a definition revolving around the balance of three basics: environmental sustainability, economic sustainability, and social sustainability (Environmental Protection Agency , 2012). To harness the advantages of sustainable practice by applying these three sustainability basics (Bonda & Sosnowchik, 2007), sustainable interior design should combine all materials and systems for “The purpose of minimizing negative impacts on the environment and occupants and maximizing positive impacts on environmental, economics, and social systems over the life cycle of a building” (Kang & Guerin, 2009, p. 180). Moreover, based on this, sustainability

is divided into three categories, assigned to as the three E's: equity, economy, and ecology. McDonough and Braungart (2002) illustrate this relationship, as shown in Figure 2-3 below:

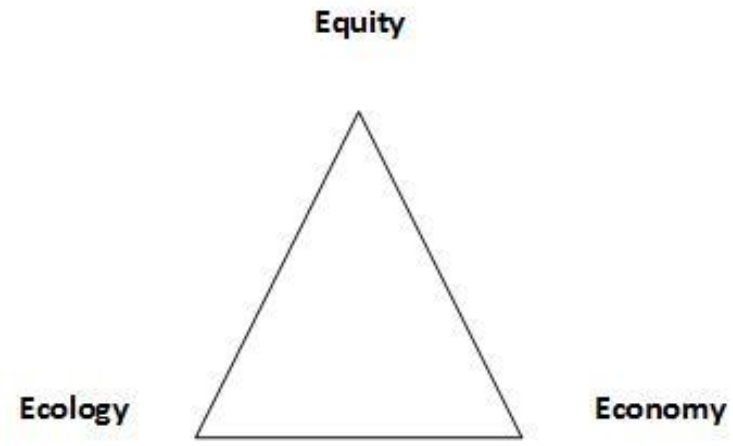


Figure 2-3 the three E's sustainable visualisations. Source: author.

The stability between equity, ecology and economy places an importance on the interconnected and reliant connections between people, their environment and business expansion and growth. The balance formed by the three E's further advances holistic thinking within the sustainability movement (McDonough & Braungart, 2002).

2.3.1 Economy in sustainability

The economy class of maintainability is essential since it is highly connected to employment, budgetary development, and innovative movements. Organisations must consider monetary advancement and productivity to survive in the economy, and financial designers have the duty to give shareholders confidence and to increase profits without hurting the regular world and the general population inside it (McDonough & Braungart, 2002). For instance, many organisations look to produce an item as cost efficiently as possible without considering how the advancement of that item and its assembly influence the earth; consequently private enterprise can be greedy (Hawken, 1993) While

business is essential for financial development, improvement has prompted an extraordinary demolition of eco-frameworks; consequently, fulfilling a more economical future involves overhauling how organisations can flourish (Hawken, 1993). A manageable organisation tries to figure out how to offer that item and make a profit without decimating the biological communities, while giving reasonable wages to workers.

Mclennan (2004) states that the reason behind designers and clients viewing sustainable design and sustainable materials as costly is only because they are not experienced enough with sustainable design and sustainable materials. Instead, Mclennan (2004) illustrates that designing sustainably will enhance the health and productivity of the building user; also, it will reduce the operating cost and maintenance of the building. Consequently, this will enhance the financial returns. Similarly, Godsey (2017) believes that the extra cost of sustainable materials is not important if these materials are minimising the harm to the environment and occupants.

Sloan et al. (2013) explains that clients tend to pay more for sustainable design in cases where this design is saving them energy, such as electricity and water, which will save them money in the long run. However, they still do not understand the benefit of using sustainable materials and think twice when it comes to paying more for a sustainable material. Sloan et al. (2013) cite hotel owners as an example, stating that they prioritise energy conservation over anything else when they have a limited budget. They meet their needs by saving money by using technologies such as solar space water heating and generating electricity via windmills.

According to Mate's (2009) study, for designers who actively practise sustainable design, cost is not a barrier while cost is perceived as a big barrier for designers who do not practise sustainable design or who practise it only when required. Further studies have shown that green buildings can cost the same or maybe less than conventional buildings (Bergman, 2011). Bergman (2011) adds that making building healthier can create benefits

such as reducing medical costs and lowering employee turnover, and therefore increasing productivity.

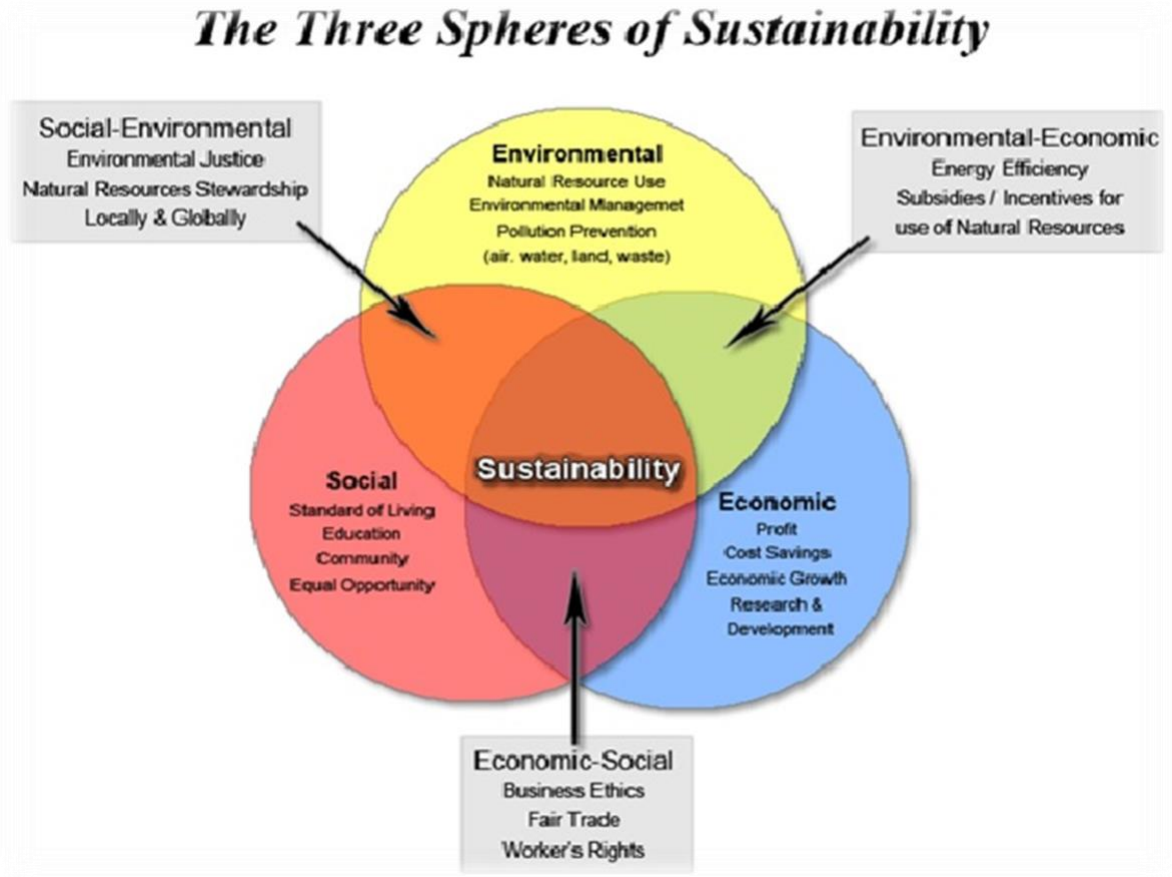
Additionally, Spiegle and Meadows (2012) stats that using green materials in design especially organic, natural or non-toxic materials can reduce the claims made by multiple chemical sensitivity (MCS) individuals under the American with disabilities act (ADA). Therefore, the economic consequence of treating individuals will be less. Also, Spiegle and Meadows (2012) claimed that cost of green materials is associated with the size, location, type and function of the building, but mainly the initial cost of a green building project is often 5 to 15 per cent higher than conventional building projects. According to Spiegle and Meadows (2012), this extra cost can save more money on the long run not only by using energy efficient operational procedures but also by using green materials which will reduce the sickness days of users, therefore, increasing their productivity.

According to Sloan et al. (2013), making a profit is the primary aim of any private organisation besides their other goals, but they will stop operating and go out of business without an advantage. These organisations adopted some sustainable practices within their organisations just because it saves them money, like installing water and energy efficient technologies by using energy-efficient equipment (Sloan, et al., 2013).

2.3.2 Social sustainability

Social sustainability can be defined as a perspective that concentrates on environment human, and development strategies. These three aspects are parts of an entire system. If the goal is to achieve sustainable development in a society, we should consider the social standards, interactions and limitations. If a socially sustainable design target is to be accomplished, these ethics become the most important terms to consider (Ayalp, 2013).

Ayalp (2013) discusses Halliday's approach to sustainability, which focuses on three aspects: environmental, economic, and social. The perspectives of social sustainability are



described as the standard of living, community and education equal opportunity. See Figure 2-4.

Figure 2-4 the three aspects of sustainability. Source: Ayalp (2013)

On the other hand, Steemers and Manchanda (2009) describe the three aspects of sustainability as consisting of plant, people, and prosperity. They explain that people constitute the social aspect, and includes the users' health, comfort and happiness.

The main issue or problem encountered in sustainable design practice is deciding the need/ or the meaning of need. The societal status is defined by way of standard of living. Although, the definition of "the need" is subject to change. The fundamental paradigm in many practices is to reflect luxury standards. In this case, the interior design practices as

general acts as an obstacle to sustainability, with limitations of the unjustified use of natural resources. Designers must think about the social standard in the measurement of both neediness and wealth. As an interior designer, it is a social obligation to set a valid and respectable definition of need (Ayalp, 2013).

Kang and Guerin (2009) as cited in Ayalp (2013), ‘‘defined sustainable interior design practice in terms of the following three dimensions: global sustainable interior design, indoor environmental quality, and interior materials. The indoor environmental quality is the most important aspect when considering the sustainability of interior environments.’’ (Ayalp, 2013, p.145). Enhancing indoor air quality, which is mostly the act of decreasing indoor pollutants, improves the quality and thermal comfort of interior lighting. Furthermore, using materials that have the opportunity of being recyclable is an added criterion for obtaining sustainability (Ayalp, 2013).

In order for the work environment of green buildings to be more comfortable and satisfying than conventional buildings, there must be few highlights that are unique or if nothing else more typical, to their design space that could add to a better natural quality. Moreover, there must be a connection amongst solace and satisfaction. Some of the attributes that identify with the indoor environmental grade, would include increased natural ventilation and the use of low-toxicity finishes and furnishings, natural source of lighting for a better quality of illumination, windows and fans that are operable and enable more customized control over ambient conditions and access to nature sounds, and replenished materials that could be considered to give a more tranquil and aesthetically pleasing interior (Paul and Taylor, 2007).

When these categories are classified from the viewpoint of interior design; it is highly evident that the design elements are the most significant aspects of creating sustainable interior living spaces. Although, none of these assessment standards is centred around the social or cultural character of issues of sustainability in interior design industry practice.

The land and its condition used to change according to the cultural and social identity of a specific society (Ayalp, 2013).

Livesey (2012) explains that happiness is a shared connection between our brains impacting what and how we see outside components, diverted through our five senses, having the capacity to modify our mind's view of reality. Poor health is the main result of a lack of happiness. In addition, 22.8% of all illnesses in the UK are classified as a mental health problem – a greater proportion than cancer or cardiovascular disease. It costs the UK £110 billion a year to treat the mental health patients, of which around £32 billion is due to lost productivity. Reducing the percentage of mental health problems would benefit the nation's economy. The indoor environment where people spend most of their time has been recognised as having a significant influence on their quality of life. The psychological and physical health and wellbeing of building users is affected by the indoor environment, for example allergies from volatile organic compounds (VOCs), and this affects their mood, concentration, and motivation (Livesey, 2012).

There is strong evidence indicating that the workplace indoor environment has an impact on performance, and on productivity and turnover as a result. On the other hand, in health care and educational buildings indoor environment elements such as layout, comfort, and daylight improve wellbeing. Many factors impact on a building user's physical and psychological wellbeing. Most of the studies into workspace impact on health and wellbeing have focused on aspects such as thermal comfort, lighting, acoustics and indoor air quality with much less attention paid to the actual materials used. Materials impact on our senses as well as the whole indoor environment. As we spend most of our time inside buildings, there is a big argument in favour of conducting testing and research on the links between the indoor environment and the user's wellbeing. Many scholars have developed tools and guides in the construction industry addressing wellbeing, but they tend to focus on one aspect such as thermal comfort, acoustics or lighting rather than taking multi-dimensional measurements (Livesey, 2012)

In the UK, the building research establishment (BRE) has shown that volatile organic compounds (VOCs), released by varnishes, glues and furnishings, cause health problems like, eye, headaches and airway sensitivity, and fatigue. Also, mould growth in interiors is identified to trigger asthma and allergies (Winchip, 2007). Winchip (2007) explains that interior designers need to address these issues, and must act to protect our endurance and mental health. In parallel, designers arguably have a responsibility to safeguard ecosystems and other species. The key to solving these issues and problems is sustainability and making a positive difference through our design choices, specifically by choosing the right sustainable materials and finishes to keep the indoor environment healthy and eco-friendly. Winchip (2007) adds that the vast majority of educators and practitioners agree that the interior design profession has a communal and ethical obligation to assist preserve our planet and the well-being, security and prosperity of people; lately, this ethos has become even more important because of the concerns associating to global warming. Due to the growth in the number of natural disasters, rising energy expenses and in response to severe global environmental problems, many acknowledge organisations linked with the built environment have prioritised sustainable design and development (Winchip, 2007).

The indoor environment air quality can be improved and be healthy for users by selecting zero or low VOCs materials (Spiegle & Meadows, 2012). Many countries have their own standards for selecting these materials. This varies depending on their definitions of low-emitting materials, for instance, the space or list of chemicals of concern. But in general any “bad” or “good” material will be found across all the standards. (UNWTO, 2017)

2.3.3 Sustainable interior design

Mendler et al. (2005) define sustainable design as the balance between human needs and their health and productivity. Pilatowicz (1995) define environmentally conscious interior design as “professional practice that attempts to create indoor spaces that are environmentally sustainable and healthy for the occupants”’ (Pilatowicz, 1995, p. 49).

Interior environments are the spaces that form the most intimate connection with the user. There is a multi-dimensional communication between people and the internal environment. The user delineates the environment; the environment delineates the user. In other words, there is a complicated and bilateral interaction between the person and the indoor environment in its social, cultural and physical dimensions. Designing interiors seize all of these dimensions to produce a sustainable environment. Interior design is a profession that assists the human habitation in the environment. In need of long-term occupancy, designing a sustainable environment is a necessity rather than a preference (Ayalp, 2013).

According to Yaldiz and Magdi (2011) as cited in Ayalp (2013) , “Sustainability is a multi-dimensional concept that has environmental, social, political, economic, cultural, and spiritual dimensions” (Ayalp, 2013, p. 143). Hence, sustainability can be defined as “a system or, in other words, an ecosystem within which various parts/elements interact” (Ayalp, 2013, p. 143). They recognised these cultural, social and environmental aspects in the profession of interior design. In this setting, designers have an obligation to design sustainable environments. That is, the indoor environment is the primary place in which to fulfil human needs in all of these dimensions.

Material is one of the essential design elements that influence the sustainability of the indoor environment. Each material has a dissimilar quality and sustainability potential. In material preference, the most significant criteria is to choose the material according to the function. Each function is associated with specific needs. In the method of manufacturing materials, the name of the energy used is called “embodied energy”. Every material has a different value of embodied energy. For instance, plastic, steel and concrete has a higher value of embodied energy in the building construction materials. In particular, natural materials like timber and stone have less embodied energy (Ayalp, 2013). Gardetti and Muthu (1995) explain that the designer’s main role is to provide occupants with a healthy indoor environment by controlling the pollution sources by selecting the right materials.

Gardetti and Muthu (2015) state that the luxury sector has a high impact on the environment and is accountable for a notable amount of consumption. Commercial interiors are generally “churned” every five to seven years, placing a heavy burden on resources and generating massive amounts of waste (Máté, 2006). Treloar et al. (1999) imply that, because of churning, the embodied energy of the fittings, fixtures and furniture can burden the operational energy expenses of an office building over a 40-year lifespan. With increasing operational energy efficiencies, this disparity will increase. Clearly, there are substantial costs linked with the selection of unsustainable materials. A large group of professionals (architects, specifiers, managers) complained about the absence of rich, complete, accessible data in the area of selecting sustainable building materials for interior design (Godsey, 2017).

Máté (2006) used a series of interviews for investigating designers’ sustainability practices. He takes note of that the dominant part of those interviewed claimed to concur on the significance and value of sustainability and design, even though their behaviour and actions in settling on decisions were frequently not steady with their proclaimed attitude. Many depended on customers or other external organisations to imbibe sustainable design practices; others evaluated the significance of environmental issues when deciding on material selection as “low” except if the client particularly asked them to choose materials for sustainable properties. The absence of trust in their insight and lack of relevant information about sustainable issues provided by suppliers was additionally a noteworthy concern” (Máté, 2006). Kang and Guerin (2009) reveal that sustainable interior materials were less frequently components of ecologically sustainable interior design than indoor environment quality standard. It likewise created the impression that interior designers were unaware about environmental issues identified with the whole life cycle of interior materials.

According to Bonda and Sosnowchick (2007) as cited in Araji and Shakour (2013), making choices regarding sustainable design requires designers to acknowledge the current

environmental materials in the market, as well as following general guidelines in the stage of selecting interior material finishes; additionally, designers need to be aware with third-party certification programmes. Designers have limited knowledge regarding the properties of materials and how they affect the environment. They need to consider the whole life cycle approach to include the environmental, social and economic aspects of their design (Araji & Shakour, 2013).

2.3.3.1 Life cycle analysis

It is not enough for a designer to consider the environmental impact of the products they specify only during the time in which these goods are being used. A complete assessment of the full environmental impact of materials may only be possible if we consider the effects they have throughout all the stages of their life (Bonda & Sosnowchik, 2007).

The Life Cycle Assessment (LCA) methodology is one of the most familiar methods, as described in the ISO 14040 standards series. The LCA methodology is handy instrument for assessing the environmental performances of a material or a product, in order to obtain an EPD certification for current material. Regrettably, the LCA tool cannot be used during the design stage, where material life cycle assessment requires a large amount of data about the material, which is not available to designers. The LCA and its analysis is also time-consuming and requires a large amount of data (Allione et al., 2012). Bonda and Sosnowchik (2007) define life cycle assessment as: “Life cycle assessment (LCA) is a scientific pursuit that attempts to chart the environmental impacts materials, products, and processes have as they flow from and to nature”.

Information gained from LCA offers understandings of the environmental impacts of raw material and product selections, maintenance and end-of-product-life plans. Because of the methodical nature of LCA and its potential as an evaluative instrument, it is gradually being used to assist in the identification of product alternatives (Bowyer, et al., 2009).

Life cycle assessment beauty as Bowyer et al. 2009 explains is that it concentrates on aspects that are measurable. Where LCA starts with the input of quantifiable raw materials data including energy, outputs of products and co-products and emissions to land, air and water. This stage on LCA called life cycle inventory (LCI) where it can include the manufacturing of a product only or all stages of production, use and disposal. The analysis of LCA is directed using international guidelines and procedures (Bowyer, et al., 2009).

Bonda and Sosnowchic (2007) state that designers pursuing sustainable interiors must think about: “how green do materials need to be?” They note that designers should focus on the impact of materials during use or on one of their features, like recyclability or energy performance; otherwise we only obtain an incomplete and probably misleading picture of their overall performance. The cradle-to-grave concept (life cycle analysis) highlights the assessment methods developed for most authorised eco-labelling systems, and its use as an outline for product development and design can be estimated to spread quickly (Godsey, 2017).

The adverse effect of buildings is eroding our very quality of living. As indicated by the U.S. Environmental Protection Agency (EPA) referred in Mendler et al. (2005), about 33% of all building suffer from “sick building” syndrome. Several studies have additionally associated healthy buildings with increased efficiency/productivity, with green, sustainable buildings creating an increase between 2 percent to 5 percent. Naturally friendly buildings give an extra advantage to building proprietors and occupants by constraining risks, for example, liability due to poor indoor air quality. Therefore, environmentally friendly buildings can add to a positive public overview. Public concern about these issues will proceed to develop, and with it will come expanding interest for solution and support for the individuals who are looking for answers to these issues (Mendler et al., 2005).

Moxon (2012) notes that sustainable design has developed as a guiding model in the production of a new kind of built environment: one that “meets the needs of the present

without compromising the ability of future generations to meet their own needs". Sustainable design has developed from a variety of issues, experiences and requirements:

-Energy efficiency gained attention due to the oil crisis in the 1970s.

-Recycling came as a result of the oil crisis in the U.S. during the 1970s and came to the notice of the building industry.

-In the 1980s, the "sick building syndrome" concept appeared, and attention for worker well-being and productivity became an issue.

-The fears regarding toxic material emissions also grew a problem that demanded to be addressed, and projects in water-scarse regions started to concentrate on water preservation.

The building sector has a noticeable impact on the environment by producing carbon emissions; indeed, designers have a huge obligation to formulate solutions to these environmental issues through the design decisions they make. Interior designers specifically can help; as they usually deal with makeover and residential projects, they select finishes and materials, and often select lighting and appliances. Interior designers must carefully consider the specification of materials and finishes in realising their designs. In parallel, they must keep in mind project location, financial plan, cleaning and ongoing repair programmes, and technical performance when looking for sustainable materials (Moxon, 2012).

Sustainable design has included the issue of toxicity (the degree to which a substance is poisonous) within its domain, since what is bad for our systems is often also bad for our ecosystem. This materials topic centres on volatile organic compounds (VOCs), the chemical sensitivities of individuals, and carcinogens. Because VOCs are volatile, they can change state from a solid or liquid to a gas. These gases and particulates together affect indoor air quality (IAQ). The solvents in paint thinner are an example of such compounds. People ingest these solvents when they breathe in the fumes of these volatile compounds

after they have changed from a liquid to a gas. Because these compounds are organic, they can interact with our bodies' processes and mechanisms. There is a wide range of tolerance among different people. Some people's bodies react dramatically to chemicals in their environment, while others report no ill effects because of their bodies' current ability to maintain a healthy stasis. While IAQ can be improved with more sophisticated ventilation equipment that manages how much fresh air is changed per hour (ACH), it is much better to specify materials that do not emit VOCs. Sick building syndrome is another issue related to air quality. For a variety of reasons, some buildings have a higher incidence of illness among the people who work or live in them (Moxon, 2012).

Habitually, the interior design profession has limited itself to a one-dimensional mode, where the focus is on providing aesthetic improvements to an interior space for a client (Hayles, 2015). Yang et al. (2011) describe the traditional interior design as comparatively late and conservative, only concentrating on style and luxury design in small environments; this is a formulation that neglects energy conservations and emissions reductions, and does not address the negative impact on consumers' emotional and physical well-being as well as environmental contamination.

However, in recent years interior design has experienced a vast change in design strategies aiming to provide healthy indoor environments for individuals to work, live and play in. Society is starting to recognise the interrelation of buildings, people and community in the production of responsible environmental buildings; clients are starting to understand their part and influence on the environment. This curiosity in environmental responsibility has resulted in need of environmentally sustainable interior design (Hayles, 2015).

Various factors ought to have prompted an expanded interest in the specification and purchase of sustainable materials and goods. These incorporate a more notable familiarity with and responsiveness towards the world's insufficient natural resources; a developing interest in healthier, more energy-efficient and ecologically effective homes and

workplaces; the establishment of green building councils and their advancement of policies and programmes supporting the execution of green building projects, for instance, BRE's Environmental Assessment Method (BREEAM) in the UK, Leadership in Energy and Environmental Design (LEED) in the U.S, and others, suggesting motivations to "go green", like, tax credits for the environmentally efficient building; and environmental protection organisations taking the initiative in effectively applying greener building policies (Hayles, 2015).

As reported by the World Watch Institute (US Department of Energy, 2003), nearly 10% of the global economics includes building construction, maintenance and equipment, which consumes between 17% and 50% of the world's natural sources and causes immense harm to the environment. Buildings also affect the well-being and prosperity of their tenants through indoor air quality. Indoor environments have been revealed to significantly impact rates of lung disease, allergy and asthma symptoms, sick building syndrome and worker production (Pilatowicz, 1995).

The realm of green building encompasses a huge number of topics, issues and compromises. As if there were not enough questions to deal with in the design and construction of building before the emphasis on green building began, since its emergence the factors to be considered have multiplied in many diverse ways. Everything from species migration patterns to new carpet smells are now well within the realm of concern for green building practitioners. That said, green building is but one of many important factors in achieving sustainability. Concerns about global warming natural disasters, endangered species, carbon footprints, and resource depletion of fossil fuels and non-renewable energy sources are highly complex subjects. It is difficult to determine exactly how big a contributing role building design and construction play in the larger picture, simply because everything is so intertwined (Rider, 2009).

Today, sustainability seems less like a single characteristic of design, for instance, using explicitly sustainable materials, and more like a systemic challenge that requires looking at

how all the components fit together as a unity. It may not simply be a case of applying certain materials to save energy or decrease carbon emissions but more about examining the big picture. It is not so much the particular materials that are used but what is done with them. There is much more to sustainability than the materials used and whether a house uses too much air-conditioning. It includes the whole habitus of the society, the total of all the things that permit a community to sustain itself physically, culturally and socially over the longer term. It is what makes the community unique and encompasses the physical environment (including climate), the language, the cultural heritage and the memories of people, without which there would be no culture, language or competence in the performance of everyday tasks (Rider, 2009).

Gladwin et al. (1995) classified features such as inclusiveness, prudence, connectivity, safety and equity as crucial elements of sustainable development based on a content analysis of different definitions. These elements accommodate us with a necessary framework for investigating the possible relationship between luxury and sustainability (Kapferer, 2015; Kapferer & Michaut, 2010).

Gardetti and Muthu (2015) state that although LCA provides benefits (such as providing an understanding of the carbon footprint of any product, system or service in a comprehensive way in order to reduce it; discovering the performance of a material or alternative materials to provide the best performance; discovering the most cost-effective materials; and supporting the market with more sustainable products or materials), no systematic and comprehensive LCA has been carried out for a full processing of luxury textiles.

2.3.3.2 Flooring materials

VOCs can result in various health effects ranging from the mild, for example, eye, nose and throat irritations, headaches, decrease in concentration, and nausea to more

concerning sicknesses such as damage to the liver, kidneys and nervous system. Emissions of VOCs by flooring materials have pulled significant interest since flooring materials (e.g. carpets) occupy a large area and comprise of layers made up of various materials. The factors for emissions vary significantly, depending upon the carpet type. At present till date, no guidelines or rules exist at the European level that regulates the maximum permissible emission of total or individual VOCs from carpets. The ones that exist are merely for voluntary basis, which is country-specific and are mostly concentrated around the north European region. The most well established European labelling scheme for carpets remains the 'GUT' (Gemeinschaft Umweltfreundlicher Teppichboden), which first appeared in the market in 1990. In the United States, the Carpet and Rug Institute embraced in 1992 the so-called CRI Indoor Air Quality Carpet Testing Program, with keeping in mind the end goal to assist consumers with identifying low-emitting carpets has defined some limits for the maximum permissible emissions. Carpets that meet these criteria points are given green names (Godsey, 2017).

The health consequences of chemicals and toxic materials found in material finishes and often specified by interior designers include the following:

Toxic material	Where it was specified	Effect
Antimony	Found in fire-retardant finishes.	
Arsenic	Found in pressure-treated lumber as a naturally occurring heavy metal used as a preservative.	Long-term exposure to arsenic has been linked to cancer of the bladder, lungs, skin, kidneys, nasal passages, liver, and prostate.

Bisphenol	Found in paints, coatings and adhesives.	Responsible for reproductive dysfunction.
Cadmium	Found in plastics and pigments; is a heavy metal used in pigments for red, orange and yellow.	Causes brittle bones and kidney damage.
Chlorofluorocarbons (CFCs)	Found in solvents; a synthetic chemical that reacts with chemicals high in the atmosphere.	Resulting in depletion of the earth's protective ozone layer.
Dioxin	Generated during the manufacture of materials containing polyvinyl chloride(flooring, wallcoverings, paint, plastic liners, etc) and in bleaching and incineration as part of the production of materials used in interiors. A component of plastic that is released when it breaks down or is burned in landfills.	Causes endocrine problems.
Formaldehyde	Found in sheet building products, textile resins and glues.	Causes cancer.
Furans	Found in some grouting products, in the energy derived from burning fuel, and used in the synthesis of nylon.	Causes cancer.

Halogenated compounds	Commonly used to make flame retardants and in polyurethane foam for upholstery.	Are persistent bio-accumulative toxic chemicals thought to cause neurological and reproductive problems and are banned by the EU.
Lead	Found in existing paint finishes.	It is a toxic, bio-accumulative heavy metal.
Mercury	Found in electrical switches and fluorescent lamps.	It is a toxic, bio-accumulative heavy metal.
Perfluorinated chemicals (PFCs)	Found in stain repellents.	Are thought to cause thyroid problems and some cancers.
Polychlorinated biphenyls (PCBs)	Used in paint, plastic and rubber.	Are bio-accumulative and are cancer causing in humans.
Polyvinyl chloride (PVC)	Common plastic, 70% of which is used in the building industry and found in fabric, furniture and finishes.	Is linked to the production of dioxin in the atmosphere and requires many harmful additives (heavy metals and plasticisers like phthalates).

Table 2-3 Toxic emissions specified in interior design materials. Source: Godsey (2017)

According to the Environmental Protection Agency (EPA), VOCs are up to ten times more intense in interior environments than in the open. Another problem being encountered comes from the synergy or interaction between two or more different chemicals. Two chemicals that may emit gas are not problematic by themselves, but when they meet each other, they bond, thus forming a chemical with different properties than the two original constituents; this third chemical can be problematic (Godsey, 2017).

2.3.3.2.1 Carpet flooring material as a case study

Annually, 1.5 billion square yards of carpet are installed. Carpet is the most frequently specified flooring material and only a few materials can compete with carpet in terms of its acoustic, thermal or aesthetic characteristic (Godsey, 2017). Dutfield et al. (2011) state that carpets are used widely in the non-domestic sector in the UK because of its noise reduction and overall comfort for users. In the UK, approximately 400,000 tonnes of carpets are thrown to landfill yearly, which is becoming more unrealistic due to increasing landfill charges and reduced availability. Carpets are a composite of layers of different materials. A typical carpet contains of four layers, as shown in Figure 2-5; separating these materials and reprocessing at the end of their useful lives is difficult and costly. Carpets are labelled as textiles within the waste streams, and textiles estimate for about 2% to 5% of all waste going to landfill in the UK. This might appear to be a small amount but it is worth noting that carpet waste has low volume density and hence constitutes high volume of landfill (Sotayo et al., 2015).

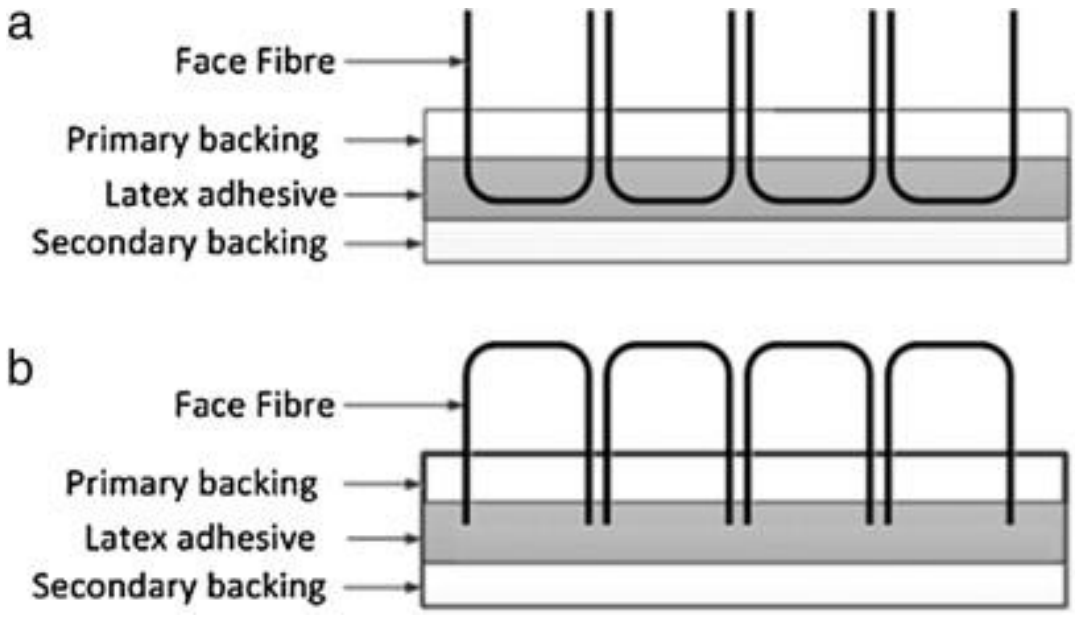


Figure 2-5 typical carpet construction: (a) cut pile (b) level loop. Source: Sotayo et al. (2015)

Carpets provides the highest sound absorbency of all flooring materials and superior thermal insulation compared to other floor surfacing materials. Additionally, carpeting reduces noise impact, and is comfortable to walk on and slip-resistant (Binggeli, 2008). It is considered to be a textile and is made from the same fibres that other textiles are made from. The features of a carpet will depend on the fibre and yarn characteristics and its structure (Godsey, 2017). Carpet materials and installation are both considered as more economical than other types of hard flooring (Binggeli, 2008). The characteristics of the carpeting and the type of installation work together to satisfy the design programme. Fibres have inherent characteristics created by: their individual chemistries, natural or man-made in origin; yarn characteristics of denier (thickness), degree of twist, and number of plies, whether the face is looped or cut. These characteristics, combined with installation, affect design possibilities and performance characteristics (Godsey, 2017).

Carpets has a limited lifespan of 5–11 years (Sotayo et al., 2015) and require regular vacuuming and spot removal. Where old carpets go to landfill, some manufacturers make carpets from recycled materials where these carpets can be recycled to something different after use (Binggeli, 2008). Binggeli (2008) adds that the backing of the carpet can affect a carpet's ability to be recycled, and carpet backings are increasingly made from recycled materials.

Sotayo et al.'s (2015) study shows that there are five options for the carpet waste process (see Figure 2-5): turning carpet waste to energy is the most common option, where carpet waste is used as a fuel instead of traditional sources. This waste process accounts for the highest percentage (58%) of all carpet waste processes in the UK. But this carpet waste process has a negative influence on the environment due to the production of ash, which can lead to soil and groundwater pollution. Another carpet waste process is the re-use of carpet waste. Carpets are removed from buildings for different reasons including for being dirty or stained, worn out, wanting a change of style, or being fire damaged (Sotayo et al.,

2015). Biehl et al (2007) cited in Sotayo et al. (2015) state that disposed carpets which can still be reused usually undergo trimming, cleaning and re-colouring for second life usage. Bird's (2014) study (cited in Sotayo et al., 2015) shows that this carpet waste process is the most cost-effective method to recycling. It is also recognised as the most favoured choice because it leads to large reserves in the depletion of natural materials, energy and a reduction in greenhouse gas emissions. However, carpet re-use accounts for only 1% of the total carpet waste process options (Sotayo et al., 2015). See figure 2-6.

Another carpet waste process accounting for 35% of the entire carpet waste process options is the use of carpet excess for equestrian covering application. This process depends on mixing the shredded fibre from carpet waste with sand and rubber crumbs (Sotayo et al., 2015). Fibre reprocessing of carpet waste is another option, accounting for 2% of the total carpet excess process options. This process involves the carpet being exposed to high temperatures, which creates the detachment of the face fibres from the other carpet elements. This process is called the depolymerisation technique, where the nylon used in the original carpet can be recovered and used again in the making of a new carpet while other components such as the backing and adhesives can be sent to landfill (Sotayo et al., 2015). Nevertheless, Miraftab et al.'s (1999) study (cited in Sotayo et al, 2015) shows that the process of recycling nylon through the depolymerisation technique in the creation of a new carpet might be more expensive than the normal method of producing a typical carpet.

The last carpet waste process option accounts for about 4% of all options and is the plastic reprocessing of carpet waste. This process is cost-efficient compared to the depolymerisation technique process. It requires tearing carpet waste at a high temperature and then extruding this to produce a combined mixture applied in the construction of injection-moulded thermoplastics. The mechanical properties of this mixture is poor, where this combination may consist of several kinds of plastics like nylon and polypropylene (Sotayo et al., 2015).

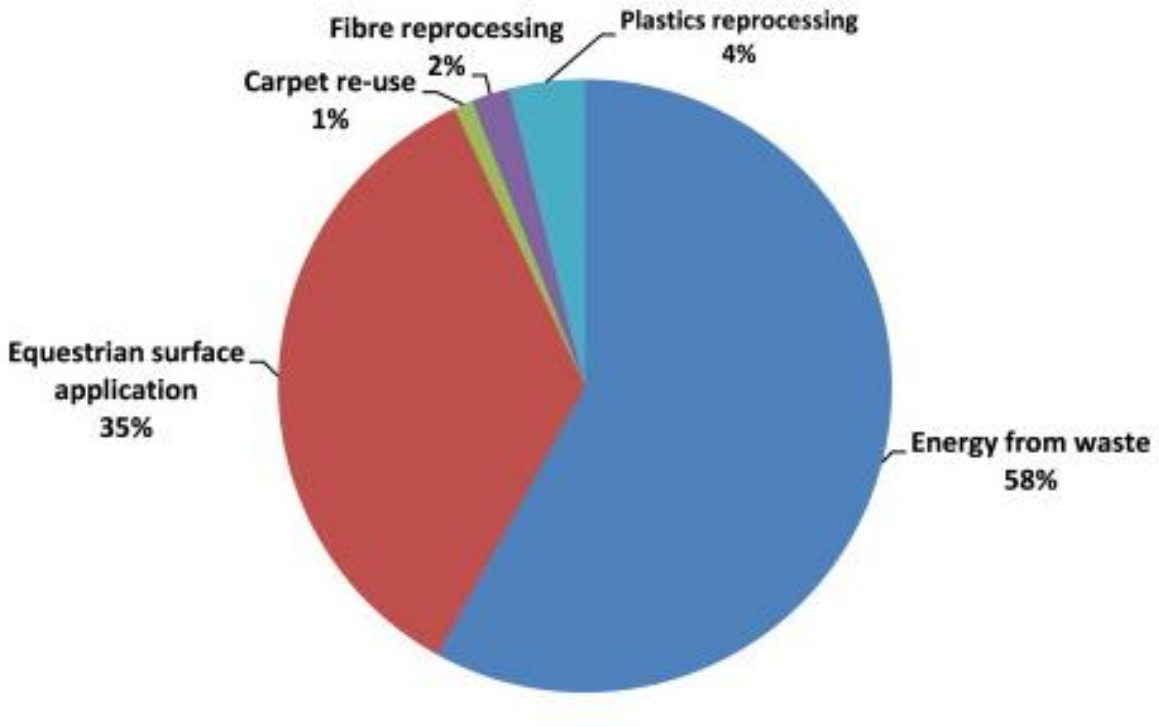


Figure 2-6 Carpet waste process options. Source: Bird (2014) as cited in Sotayo (2015)

Gardetti and Muthu (2015) describe luxury carpet as a carpet made of superior material like animal hair or silk, which are regularly hand made. They add that there is a lack of interest in this kind of carpet undergoing the recycling process due to its small quantity. Another reason for calling a carpet luxury, as Gradetti and Muthu (2015) explain, is that carpets can be customised by producing them from high-quality materials or producing them in tiles so the client can easily combine carpet tiles and create a unique interior design. Carpet weight plays a major role in terms of the application area. In places such as the transportation sector, the lightest-weight carpets are preferred, while the opposite is true in the contract sector such as hotel rooms where a heavy-weight carpet is preferable to fulfil requirements like noise insulation (Gardetti & Muthu, 2015).

Carpets are constructed using different methods (see Table 2-1). The most common carpet construction method is the process used to create tufted carpet. Tufted carpets in Europe account for 480 million m^2 of carpets annually (Gardetti & Muthu, 2015). Tufted carpet accounts for roughly 76% of all carpets produced in the UK due to their low cost and high production standard (Sotayo et al., 2015). Tufted carpets are made of lengths of yarn. By inserting pile with needles into a primary backing, tufts are formed to create several layers that are firmly joined together. The end user only comes into contact with one layer. They can be cut with a knife on the tufting machine to form a cut pile surface to the carpet. Tufts which remain uncut form a loop on the carpet surface. Both cut and loop can be used together in a carpet to produce a textured surface. This can be applied for both tile or modular carpet and broadloom carpet. The only difference is the backing, where the tile backing is made of bitumen mixed with ground limestone as a filler, polyurethane, PVC and thermoplastic mixed with fillers. On the other hand, the broadloom carpet backing is made of primary materials in the tile backing but the secondary material is different, generally made from textile fabrics or felts(polypropylene, polyester or jute) applied with latex (Binggeli, 2008; Dutfiled et al., 2011; Gardetti & Muthu, 2015). See Figure 2-7.

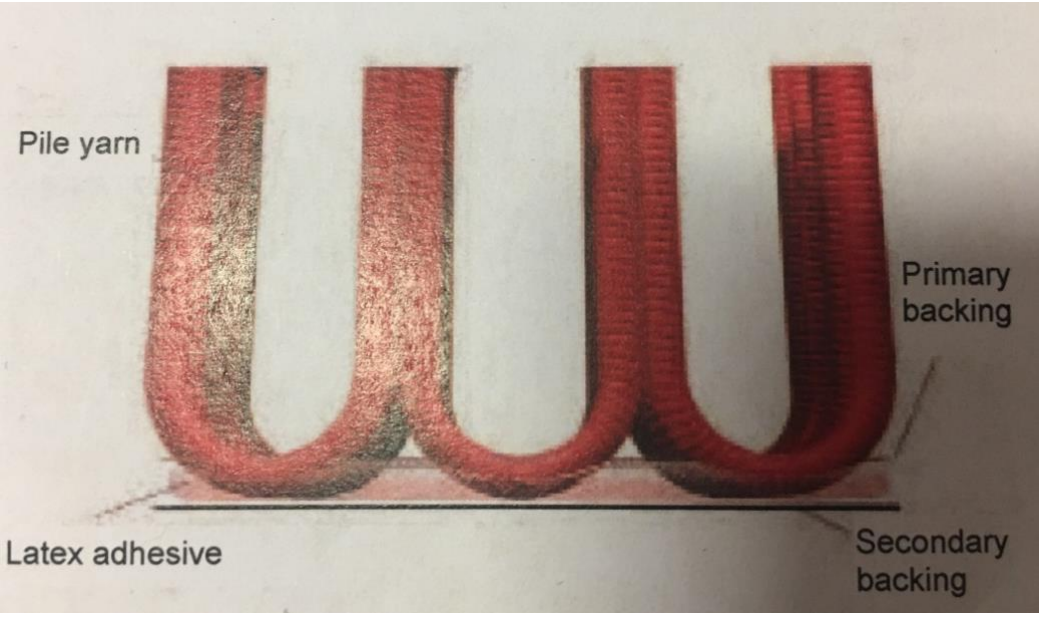


Figure 2-7 tufted carpet construction (side view). Source: Dutfield et al. (2011)

The second most common type of carpet construction is woven carpets, which have the longest history, and are still constructed by hand in some parts of the world (Binggeli, 2008). Weaving carpets takes more time and its process has a premium cost, which costs more than tufting (Binggeli, 2008). For economic reasons as well as for wearability and durability, wool is mixed with synthetic fibres. The two most common blends are 80% wool, 20% nylon for Axminster carpet, which can also be made of 100% wool, where this construction is the most durable and long wearing one. The other blend is 50% wool, 50% polypropylene for the Wilton carpets (Binggeli, 2008). Wilton carpet is made from a single colour in the same warp course, in the production of which there is no provision for alternative selection of pile yarns. On the other hand, a patterned Wilton carpet is produced on a loom with a jacquard or other patterning mechanism with the design being obtained by a pre-determined selection of the required colour of pile yarn. The Axminster carpet is a cut pile carpet produced by inserting, during weaving, successive rows of tufts

with colours arranged according to a pre-determined order (Dutfield et al., 2011). See Figure 2-8.

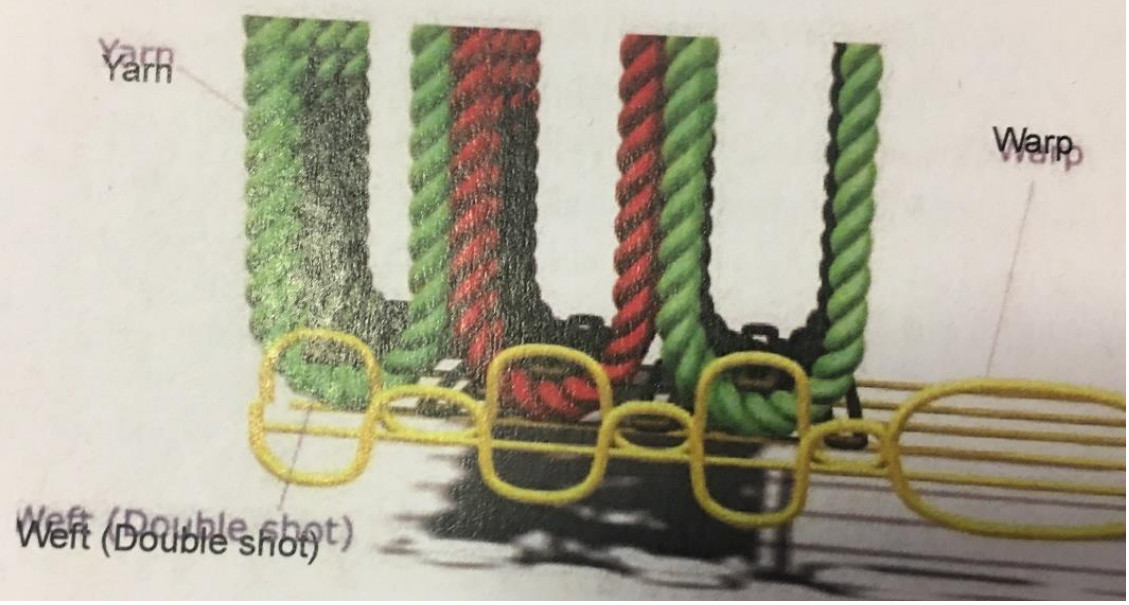


Figure 2-8 Axminster carpet construction (side view). Source: Dutfield et al. (2011)

The third type of carpet construction is bonded carpet. There are two kinds of bonded carpet: fusion bonded, which is assembled in facing pairs with the pile fixed in the backing of each side, and cut carpet, producing the cut-pile carpet (Binggeli, 2008). Fusion-bonded carpet consists of an assembly of textile yarns or fibres secured by a hot melt adhesive directly to a backing support, which could be a synthetic polymer or a natural material (Dutfield et al., 2011). Fusion-bonded carpets are more expensive than tufted carpets, and are more flexible in terms of patterning for carpet tiles than tufted carpets, but as the technology of tufted carpets has improved, it has gained a major segment of the market (Binggeli, 2008). The other type is the fibre-bonded covering, which is needle punched or needle felt, where the textile floor coverings are produced by the needling of the textile materials or bonding by physical or chemical processes. A commonly used fibre blend for fibre-bonded carpets is 80% polypropylene, 20% nylon. Bonded floor coverings are back-

coated with latex for broadloom carpet or backed for tile production as tufted carpet (Dutfield et al., 2011).

Knitting and needle-punched are other types of carpet construction, but they are not common like the previously mentioned types. The knitting process is not widely used in the carpet market. The needle-punched process produces a flat carpet which is usually used for outdoor areas by coating it with weather-resistant latex (Godsey, 2017). See table 2-3.

Method	Construction	Appearance and characteristics	Uses
Tufting	Yarns are poked through primary backing and stabilised with a secondary backing.	Pile construction looped or cut; depends on secondary backing for stability.	Most common broadloom construction; has many uses residentially and commercially.
Woven	Simultaneous construction of face and backing.	Pile construction for Axminster, Wilton and velvet looms; very durable construction, complex patterns.	Casinos, hotels, and other high-traffic locations.

Knitted	Integral face and backing formed simultaneously.	Loop pile construction stabilised by secondary backing.	Commercial interiors.
Fusion bonded	Yarns set in adhesives.	Cut pile.	Commercial and carpet tiles.
Needle-punched	Fibres matted/felted together and locked in place with adhesive spread on the back.	Felted appearance.	Tiles and rugs.

Table 2-3 Comparison between the most common carpet construction techniques. Source: Godsey (2017)

Carpets are mostly manufactured in 12 feet (3.66 m) strips, referred to as broadloom carpet. Some speciality carpet comes in widths up to 18 feet (5.5 m). Broadloom carpet usually consists of two basic pile types, cut or loop. Patterned carpet combines both of these, or uses loops with different heights. Carpet tiles comes in 12 or 18 inch (30.5 or 45.8 cm) squares, and are mainly used for commercial projects (Binggeli, 2008).

Godsey (2017) explains that the finishing process starts after constructing the carpet, and includes the following:

- Attaching the secondary backing.
- Attaching a cushion, so that a separate pad is not required.
- Applying finishes to the carpet such as antimicrobial or antistatic finishes.
- Cutting the carpet into tiles and attaching a high-density foam cushion to it. (Godsey, 2017)

- **Carpet materials**

Carpet provides places with sound absorbency and thermal insulation. It is considered as a textile and is made from fibres that other textiles are made from. The features of the carpet will depend on the thread and fibre characteristics and its structure Fibres have inherent features generated by their source; whether they are natural or man-made; the thickness of yarn, degree of twist and number of plies; and the type of carpet face, cut or loop (Godsey, 2017).

Increasing the number of plies produces a thicker yarn, which enhances the performance and look of the carpet. Yarns vary between low twist to high twist. The mixture of thickness of yarn, amount of plies and the amount of twist produces the appearance and performance of the carpet. This will be explained further later in this section. See Figures 2-9 and 2-10.

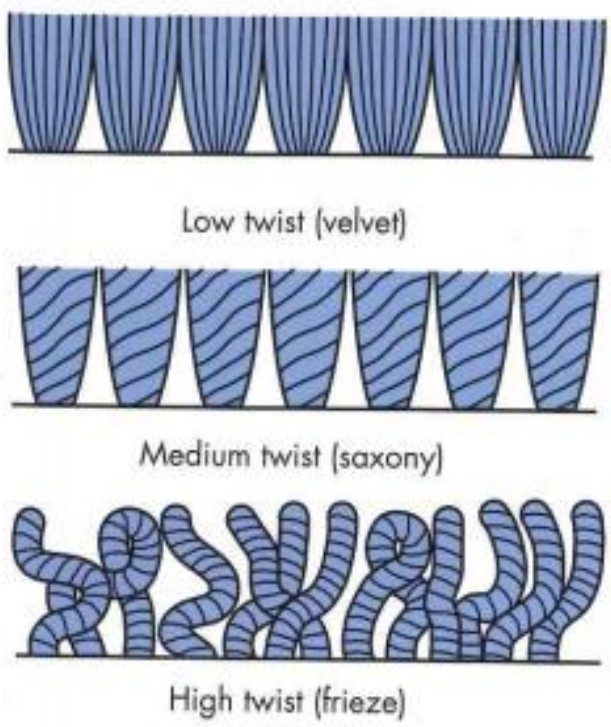


Figure 2-9 the degree of twist affects the appearance and performance of carpet. Source: Godsey (2017)

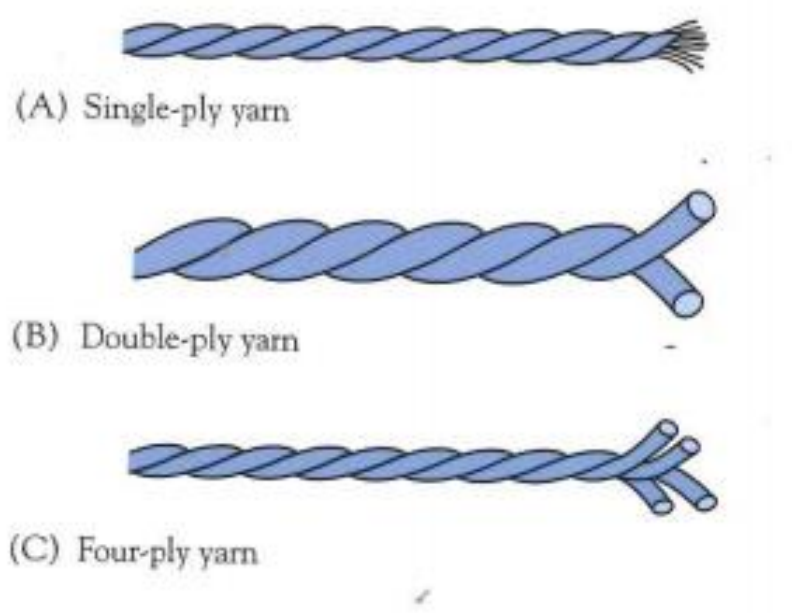


Figure 2-10 the number of yarns twisted together are called ply. Source: Godsey (2017)

- **Natural fibres**

Natural fibres include all the fibres taken from plants and animals, like producing silk carpets from silkworms or wool carpets from cheeps (Godsey, 2017).

1- Wool

Wool fibre used for carpet is nearly always from sheep. Wool is a moderately expensive fibre in comparison to other threads. It is the example by which other fibres are measured because it is delicate and elastic and can be easily bleached and coloured to any shade that your job needs. It is naturally stain resistant (not stain proof) and also naturally fire resistant. It is said to lifetime gracefully. Wool is subject to static electricity and in some fittings may need exceptional treatment to resist this problem. If crushing of fibres is the most likely kind of abuse that carpet will suffer in your client's installation (flattening from

footfall, relocation of furniture within the room, etc.) and price is not a restriction then wool would be a good choice for the area (Godsey, 2017).

Although there is competition between hand-made fibres and wool, wool still has a special place in the market because of its unique benefits such as high thermal insulation and softness (Kumar et al., 2017).

The wool produced from sheep in the UK is predominantly used in the manufacture of carpets. In New Zealand sheep are reared on much larger farms or stations, and although they were also mainly used for making carpets the market has now shifted to the production of meat, just like the UK. However, a better quality of weather and pasture in New Zealand results in much better quality wool in terms of yield (the amount of clean fibre). A 70% scoured yield has been assumed for British wool and 75% has been assumed for New Zealand wool, where better rearing conditions result in less fleece contamination and hence a better yield. Recently, there have been changes by farmers regarding the use of sheep dip pesticide in the UK, which could have a substantial impact on the cradle-to-gate impact of wool. More information in UK agricultural and manufacturing data on wool fibre and yarn would give a more comprehensive basis for future assessment (Dutfield et al., 2011).

2- Silk

Silk is a protein fibre, like wool (Godsey, 2017). Silk is the most luxurious raw material and fibre produced by worms. It has usually been related to wealth and luxury as it has been named as “the queen of fibre” and there are different kinds of wild silk found in many countries (Gardetti & Muthu, 2015). Gardetti and Muthu (2015) state that the production of silk fabric by weavers has a nearly a zero energy footprint and meets most of the sustainable guidelines for sustainable fabric production. Organic silk is the most environmentally friendly as it does not require any chemical treatments, and the silk

worms' lives are not threatened as they live and die naturally. Silk found in broadlooms is typically part of the patterning in a wool carpet. The lustre and excellent denier are applied decoratively as a contrast to the wool carpeting field, or ground. While silk is a solid fibre, it is not flexible. It is more costly than wool, so sometimes rayon is substituted because it shares many properties with silk in terms of lustre and appearance but is less expensive than the silk fibre that it imitates. However, rayon does not resist flames as well as silk does (Godsey, 2017).

Because they are protein fibres, silk and wool shrink away from flames and are difficult to ignite. Of the two, wool is much more common in carpet manufacturing. Its flame resistance may indicate its use in commercial buildings. Silk is not cost-effective or long-lasting enough for the commercial sector. Wool carpet, however, can be used commercially for light-traffic installations (Godsey, 2017).

3- Cellulosics

Floor coverings produced from cellulosics fibre are a plant-based fibre like rayon. They are not fire resistant, and are not as elastic as wool or as long-lasting as synthetics. So, usually this kind of carpet is intended for the residential market (Godsey, 2017).

4- Linen

Linen is applied in limited quantities in a broadloom carpet. It is usually used in blending with wool. Linen is sturdy, has a lustre, and dyes well. As is the case with all cellulosic fibres, linen must be dry brushed with techniques that use water or steam (Godsey, 2017).

5- Cotton

Cotton is delicate, and subject to weather; plus it will stain quickly. It is not common in carpet because of damage and staining weaknesses; however it is available because it is irresistibly smooth under bare feet. Any carpet will suffer if cleaned inappropriately, and cotton must be cleaned correctly as per the manufacturer's instructions. When cleaned with water, cotton fibres may clump together, so it can be difficult to restore the carpet's original appearance (Godsey, 2017).

- **Synthetic fibres**

Human-made fibre from petroleum and other origins of plastic starts life as plastic pellets that are dissolved into a solution. This solution is expelled into long, constant filaments. These filaments might be turned into yarn or treated first to be bulked, and crimped fibres are called bulked continuous filaments (BCF), meaning it is a long uncut strand of man-made

Fibre, heat set into a zigzag strand. BCF may be spun into yarn or cut into short staple lengths to imitate the staple construction of wool and then spun into yarn (Godsey, 2017).

1- Nylon

Nylon is thought to be the most long-lasting fibre for abrasion resistance. It also resists fungus, mould and insects. It is hydrophobic because it does not quickly absorb water or waterborne spots. Nylon is such a tough fibre that manufacturers remain to invest in developing it because market demand is high. Fibres can be described as first, second,

third, fourth, fifth and sixth generation. Interim fibre improvements, like the latest nylon 6.6, are also distinguished to make specifiers aware that this nylon is an improvement on generation six. Nylon 6 and 6.6 are the ones presently used for carpets. Nylon is more abrasion resistant than wool but more likely to damage in busy areas. It is said to “ugly out” before it wears out. Recognising that the product is still serviceable when judged to be unattractive, carpet manufacturers will sometimes take back carpet and apply a printed pattern to the face to camouflage crushed traffic paths. The same carpet can then be reinstalled in the facility with its new, fresh look (Godsey, 2017).

Nylon 6 and 6.6 make the carpet more elastic and firmer with enhanced colouring. Carpet maintenance experts note that the difference between the two is that the improvements of nylon 6 are even more pronounced in 6.6, which has a more elaborate dyeing process to make the colour more durable. There are also claims that it resists stains better, but once it does stain, it is harder to clean. Nylon 6.6 is more difficult to recycle than nylon 6 (Godsey, 2017).

Nylon is generally subject to the build-up of static electricity. Static dissipative carpet incorporates metallic fibre and special glues for environments that are particularly delicate to static build up. For clients that expect high traffic to abrade fibres and wear out the carpet in traffic areas, then nylon will be a good choice for their installation (Godsey, 2017).

2- Polypropylene

Polypropylene is also named olefin. It has excellent stain resistance because of its hydrophobic characteristics, and it is fade resistant when it is solution coloured. This fibre applied for indoor/outdoor carpet. It is durable against abrasion, but it flattens in busy areas, or under heavy furniture, and relies on the structure to defeat this problem (a low dense loop is typical). Olefin is a low-priced fibre compared to others. It is oleophilic,

indicating that it has an affiliation with oil-borne stains. It is sometimes combined with wool to lower the cost of wool carpet because it is flexible like wool and texturally alike. (Godsey, 2017).

3- Acrylic

Acrylic fibre is elastic and resilient. Its hand associates well to wool in many aspects. It has low abrasion protection and can sometimes pill, particularly if part of a blend. It can be liquid coloured, making it resistant to fading (Godsey, 2017).

4- Polyester

Polyester is delicate and wear resistant, dyes well and resist fading, but has low elasticity and depends on high density to defeat this weakness. Because it is a heavy fibre that provides excellent coverage for small material regarding weight, some producers skimp on thickness. Low-density carpets show grinding as the threads fall over, revealing their sides, so they do not maintain their good appearance in busy traffic areas (Godsey, 2017).

- **Yarn**

Whether natural or man-made, fibre goes through a number of processes before it is ready to be fashioned into floor covering. The fibres are gathered into yarn bundles and texturised into increased bulk and coverage. Texturising converts the vertical filaments into kinked or curved shapes that are then heat set. Floor coverings made with BCF (bulked continuous filament) are less likely to pill or shed than those made from short, stable fibre (Godsey, 2017).

Bulking involves processing yarn to provide more coverage without adding more material weight. Bulking and crimping add to fibre resilience. Crimping forms “bulk” in separate

filaments by producing a sawtooth, zigzag or random spiral relative to the thread. These processes can make carpet with low density appear more thick and plush (Godsey, 2017).

Staple fibres are small short lengths that happen naturally in cotton or wool, but artificial fibres might also be cut into standard lengths in addition to being curled and bulked. Staple yarns appear at the carpet mill in bundles (very large cubical bundles, similar to cotton bales). The bales are opened up and combined with other bundles of staple to guarantee unity. The fibres are carded, spun and bent with other strands of threads to make the final yarn (Godsey, 2017).

- **Denier and ply**

In addition to fibre characteristics, carpet gets some of its features from the denier (thickness of the yarn) and the number of plies (number of yarns that are twisted together). The effect of increasing the number of plies is to produce a denser yarn that has more elasticity or memory. This enhances the wear and appearance maintenance of the carpet. Yarns are twisted to varying degrees from a loose twist to a high twist, as seen in Figure 2-4. The mixture of the denier, amount of plies, and the volume of twist adjusts the appearance and performance of the end result (Godsey, 2017).

A dense concentration of small denier, single-ply yarns are used in velvet plush. This produces carpet with an elegant formal aesthetic. Velvet plush will show every footfall, while thicker denier, multi-ply yarns will be grainier in appearance and less formal; they provide some camouflaging of footprints and will add to the resilience of the carpet. Saxony plush will show fewer footprints than velvet plush, and frieze will show the least of all due to the increased twist (Godsey, 2017).

- **Carpet backing, pads and glues**

Tufted carpets usually have primary and secondary backing, where the primary backing is used to hold the tufts and can be made of jute (plant fibre), sewn or non-sewn synthetics cotton, and kraftcord (yarn made of kraft paper), but the most common primary backing is polypropylene. The secondary backing is used to hold the primary backing after applying adhesives like latex to the back of the carpet (Godsey, 2017). Pilatowicz (1995) suggests using a low-toxic glue or water-based glue instead of latex glue for good air quality.

Carpet pads, or cushions, can be made of foam, rubber or fibre. Pads are used to provide support to the carpet and usually weigh between 6 and 8 pounds. A weight of less than 6 pounds will not provide support for carpet, especially in heavy-traffic areas (Godsey, 2017).

- **Carpets and health**

Carpets are used in some buildings for safety reasons, to protect children and the elderly. Carpets cover most of the areas in some buildings, so the VOCs emitted from carpet significantly affect the indoor air quality. Even if the VOC levels reduce after installation and the building has been conditioned, people with allergies will still find carpet problematic (Binggeli, 2008; Godsey, 2017). Godsey explains that people with allergies cannot tolerate carpets for a simple reason, which is that a lot of dirt and dust become trapped in carpet, but the thicker the carpet is, the harder it is for the dirt to easily fall into the pile.

According to Binggeli (2008) and Godsey (2015), besides people who have an allergy to trapped dust in carpets, there are also people who are sensitive to the chemicals found in the VOC emissions of the carpet face, padding and adhesives. As manufacturers apply certain chemicals to the face of the carpet to protect it from stains, microbes and static

resistance, these chemicals emit gases. Pilatowicz (1995) states that wool carpets do not need these chemical treatments for stains, static and fire resistance because wool is normally stain-, static- and fire resistant. Godsey (2015) adds that some parts of the carpet like the carpet cushion (which is recycled from the urethane foam in furniture) contain a harmful toxin called PentaBDE (Pentabromodiphenyl ether). Therefore, this product is sustainable in one way, in that it diverts waste from landfill, but on the other hand it brings toxins into the indoor environment.

Pilatowicz (1995), Binggeli (2008) and Godsey (2015) advise leaving the carpet for three to four weeks after installation to release its chemical emissions, which will reduce significantly. Additionally, they advise eliminating the use of latex and adhesives in low-emission carpets.

The maintenance of carpet is another problem where carpets are cleaned using toxic chemicals. Pilatowicz (1995) recommends vacuuming as it is the best way to clean carpets and remove dust, adding that interior designers should take into consideration the place, function and maintenance requirements and based on that select the right carpet accordingly (Pilatowicz, 1995).

- **Carpets standards and assessments**

Bowyer et al. (2009) state that the building for energy and environmental sustainability which (BEES) program which was developed in 1994 by the U.S. National Institute of Standards and Technology (NIST), consists of 25 floor covering products where (BEES) is the most comprehensive resource available today. Unfortunately, only the commercial building flooring materials are included in the BEES program. Also, the program does not include hardwood and bamboo. Thereby, it does not suit the ‘luxury’ market.

BEES program covers twelve categories when evaluating the flooring material: ecological toxicity, ozone depletion, human health, smog, water intake, fossil fuel depletion, habitat

alteration, global warming, indoor air quality, acidification, criteria air pollutants and eutrophication (Bowyer, et al., 2009). BEES program uses a weighting system to rate the overall environmental impact of the products by weighting the previous mentioned twelve categories to the degree of environmental impact. Additionally, BEES also provided a comparison between different flooring products based on a full lifecycle assessment where it shows that the estimated service life of the wool broadloom carpet is longer than the Nylon broadloom carpet (see figure 2-11) (Bowyer, et al., 2009). The limitations of BEES program are many, but the main restriction is that BEES cannot be used outside the U.S. where the BEES products cannot implement to products traded in other countries where production methods, cost, transportation practices and fuel mixes are different from country to another (Lippiatt, 2002).

Floor covering material	Product description	Principal raw materials	Estimated service life
Ceramic tile with recycled glass	Ceramic tiles 6 in. x 6 in. x 0.5 in. (12.7 mm) thick installed on a 0.5 in. (12.7 mm) layer of latex/mortar.	Clay (25%) and recycled glass (75%).	50 yr.
Linoleum	Sheet linoleum 2.5mm thick (0.098 in.) with jute backing and polyurethane-acrylic finish coat, and applied using a 0.01 in. thick (0.29 mm) acrylate copolymer adhesive.	Wood flour (31%), linseed oil (23%), limestone (18%), jute (11%).	30 yr.
Vinyl composition tile	Vinyl tiles 12 in. x 12 in. x 0.125 in. (0.32 mm) thick with high proportion (84%) of inorganic filler applied with a 0.03 in. (0.79 mm) thick layer of styrene-butadiene adhesive.	Limestone (84%), vinyl resins (12%).	40 yr.
Composite marble tile	Tiles 12 in. x 12 in. x 0.375 in. (0.96 mm) thick made of polyester resin and matrix filler, colored for a marble effect, installed using a 0.5 in. (12.7 mm) thickness layer of latex/mortar blend.	Limestone filler (78%), polyester resin (20%).	75 yr.
Terazzo	Terrazzo 0.375inches (9.5 mm) thick containing a high proportion of inorganic filler, pigment, and epoxy resin that is poured, cured, ground, and polished.	Marble dust and chips (77%), epoxy resin (22%).	75 yr.
Natural cork parquet tile	Natural cork sheet made of waste cork powder generated in making cork bottle stoppers and urethane binder.	Recycled cork waste (93%), urethane binder (7%).	50 yr.
Natural cork floating floor plank	Natural cork planks in tongue and groove pattern made of waste cork powder generated in making cork bottle stoppers, a high density fiberboard backing sheet, and urethane binder. In this case, the cork comes from Portugal.	Recycled cork waste (58%), high density fiberboard (39%), urethane binder (3%).	50 yr.
Nylon broadloom carpet (commercial)	Nylon broadloom carpet with backing material (but no pad) that is installed using two applications (to the back of the carpet and also spot application to the floor space) of latex glue.	The basic raw material is petroleum. The raw materials comprising the carpet and glue are nylon 6.6 (42%), limestone filler (37%), styrene butadiene latex (11%), and polypropylene backing (9%).	11 yr.
Wool broadloom carpet (commercial)	Wool broadloom carpet with backing material (but no pad) that is installed using latex glue.	Wool (58%), limestone filler (28%), styrene butadiene latex (9%), and polypropylene backer (5%).	25 yr.

Figure 2-11 description of flooring products assessed by BEES. Source: Bowyer et al. (2009)

Another standard system focused on carpet is the European standard focusing on textile floor coverings and carpet tiles, excluding rugs and runners. The standard system covers the following categories: appearance retention, wear, luxury rating, and additional performance properties (British Standards Institute, 2016). The European standard classified carpets for different levels of use in relation to the performance requirements as seen in figure 2-12 (British Standards Institute, 2016).

The

Domestic use	
21	Moderate
22	General
23	Heavy
Commercial use	
31	Moderate
32	General
33	Heavy

Figure 2-12 level of use intensity. Source: British standard institute (2016)

European standard classified carpet for luxury rating based on the mass per unit area, where the heaviest carpet is the most luxurious carpet with an LC5 class and the least luxury carpet with LC1 class (British Standards Institute, 2016). See figure 2-13 of luxury rating classes.

Luxury rating classes		
Class	**Mass per unit area of use surface above substrate (in g/m² according to ISO 8543 or EN 984)**	**Conformity without testing**
LC1	≤ 400	- Flat needled type A1/A2/A3 - Carpets without pile - Flocked carpets
LC2	> 400	- Pile needled type B3
LC3	> 600	
LC4	> 800	
LC5	> 1 000	

Figure 2-13 luxury carpet rating classes. Source: British standard institute (2016)

Additionally, the Carpet and Rug Institute (CRI) in the U.S. as a national trade association representing the carpet and rug industry had set standards for carpets and rugs to help designers and specifiers or end users to take decisions to create a pleasing visually and extended lasting environment (CRI, 2018). The CRI (2018) is widely known for adding beauty and prestige to any facility; well-chosen carpet plays a vital role in enhancing the quality and feeling in interior design, where this is a significant thing for hotels and restaurants.

CRI (2018) mentioned that colour and texture are essential factors to provide a high-performance carpet, like using a mid-tone shade for heavily trafficked areas is working well. The balance between function and aesthetic needs is the ideal carpet for any user (CRI, 2018).

2.3.4 Sustainability in the hotel industry

Globally, over the past few decades the hotel sector has swiftly developed, to become the world's main employer, employing over 200 million people. On an international range, the tourist industry is projected to account for one out of every 15 jobs. Furthermore, tourism characterises the primary source of income in some parts of the world. The tourism industry has been shown to pose a major environmental and socio-cultural risk to many of the environments in which it is developed and pursued, with the hospitality industry consuming large amounts of energy to provide guests with comfort and luxury. This energy consumption has an effect on the environment due to emissions and pollution (Bohdanowicz & Martinac, 2016).

Hotels are unlike the education and commercial office buildings generally covered in buildings research. First, office buildings and schools have long-term occupants occupying the building, while conversely hotel tenants often change daily. Hotels are also characterised by more extensive facility offerings, significantly superior back-of-house areas, and encounter considerable levels of damage and tear on equipment, furniture and amenities than educational and commercial office buildings; this involves different running schedules for various functional departments in a hotel building and the number of such facilities (restaurants, in-house laundry, business centre, etc.). Hotels usually encounter higher worker turnover percentages than office buildings, schools or hospitals. Similar to hospitals, but unlike schools and office buildings, hotels are open 24 hours per day, 365 days per year (Rotimi et al., 2017).

Sustainable approaches to interior design within hotels play a significant role in today's climate. Hoteliers and consumers have become more environmentally conscious. Many hoteliers are starting to react to environmental trends in the industry. Although the trends in many commercial and public sectors have begun to adopt green building principles in

the new building, the hotel sector has been slow to catch. Alongside satisfying customers and meeting their needs, hoteliers should focus on implementing low-impact interiors, create productive and healthy places in which to work and stay, and pass tough standards to accomplish accreditation from one of the globally identified "green" building certification systems, such as BREEAM (the Building Research Establishment Environmental Assessment Method) (BRE Global, 2011).

Most hotels that have started to follow environmental trends have done so through operational plan adjustment, not building design procedures. For instance, they request hotel visitors to choose to forego the towel service as a method to decrease the use of detergents and water (Cain, 2007). Hotels have also demonstrated sustainable practice by using energy-efficient lamps in guest rooms and non-public areas. In addition, signs have been posted in rooms requesting guests to turn off lights and the television when leaving the room. In larger hotels, sub-metering systems have been installed to identify areas of energy waste and defective equipment (Winchip, 2007). Both business tourists and holidaymakers are increasingly assuming their hotels to demonstrate environmental and social obligation, while also accommodating expected levels of luxury, service and comfort. In a recent study of Canadian business travellers, over 40% declared that the environmental influence of their hotels was essential to them. And a quarter of holidaymakers and over 30% of business travellers actively searched for hotels with green certification (Richardson, 2016).

There is now more interest in using low-impact interiors to create productive and healthy places in which to work and stay (Benson, 2013). Sustainable interior design maximises the positive and decreases the adverse impact on the life cycle of a building (Kang & Guerin, 2009). Interior designers can help to maximise these positive effects on hotel owners, employees and visitors through selecting the appropriate interior finishes and materials that meet this need. Materials specified for interior use is one of the main aspects through which interior designers can make a positive contribution to

sustainability. However, the evaluation of interior materials for the hospitality industry in terms of sustainability, luxury and cost efficiency is a challenging task (Ahn & Pearce, 2013). Indeed, environmental concerns require to be balanced with the guests' demands. Debra Patterson, the environmental representative at London's The Savoy hotel, stats that careful design, including bathroom design, was at the focus of the property's recent £200m refurbishment agenda. The plan was to deliver the exclusive facilities guests would expect while "seamlessly blending sustainability and luxury without compromising the product for our guests" (O'Neill, 2011).

A critical element of specifying sustainable interiors is to consider the materials' life cycle analysis (LCA) (WINCHIP, 2007). Materials selection has a significant influence on the sustainable end-result of all interior design projects but specifically hospitality interior design projects, which are usually renovated every five to seven years, placing a heavy burden on resources and producing massive quantities of waste. As Hayles (2015) states, there are substantial expenses connected with the choice of unsustainable materials.

Jones (2008) notes that the resources available to interior designers do not support the full scope of their role in the creation of the designed environment. Furthermore, although multiple resources are available regarding the use of sustainable design practices and the specification of environmentally responsible materials in the design and construction of buildings, very few are available that focus on the design of the interiors of these buildings. Lee et al. (2013) cited in Hayles (2015) states that there is little research focused on interior designers' choices of sustainable materials.

The challenge faced by the hotel industry is to balance the need for sustainable material use with the required level of luxury expected by guests in a five-star hotel. Customers now assume some mention of sustainability applications in the tourism industry. These "Green" choices are design decisions that influence the performance of the employees who maintain and maintain the property (Brody, 2014).

Hotel sector business owners attempting to be environmentally responsible, both for financial and economic efficiency, and to please their ethics, are offering green building practices. The trend towards green hotels not only marks environmental concerns by saving energy, water and sources but is also assumed to enhance guest comfort and satisfaction. Guest satisfaction, intent to return, and the possibility to recommend a hotel are essential factors for profit and success in the hospitality industry. Accordingly, in developing a new hotel, the design crew usually concentrates on areas identified to be firmly connected to these factors, namely the lobby, the guest rooms, the bathrooms, food and beverages, spas, the external environment, and the artwork showcased around the hotel (Brody, 2014).

However, there is usually the perception of some conflict between guest satisfaction and comfort and green building practices in hotels that seek sustainability. According to Kirk (1995), this may occur as a consequence of the preservation of resources, including water and energy, which could lower from a guest's experience and comfort. Luxury attributes of hotels are hardly compatible with green building practices, which tend towards smaller spaces, and materials and products that are non-exotic, recycled, natural, or rapidly renewable, with expanded use of fluorescent lighting to reduce energy usage and an emphasis on the conservation of water. Also, a green hotel is often considered to be unattractive in appearance and uncomfortable. To prevent these biases and assumptions, it is, therefore, essential to identify green building practices that can be achieved over the building's entire life cycle to decrease its environmental impact, maximise social and economic opportunities, and improve guest comfort and satisfaction (Kirk, 1995).

Ahn and Pearce (2013) define a green hotel as one that "Adopt[s] policies that are safe, healthy and environmentally friendly, implement green management practices, advocate green consumption, protect the ecology and use resources properly". On the other hand, while sustainability is defined as "Meeting the needs of the present without compromising the ability of future generation", this definition is not appropriate to describe a green

luxury hotel where luxury hotels are about big spaces and providing their guests with comfort.

2.3.5 Environmental assessment methods

When evaluating products and materials, it is important to look beyond the claims made by manufacturers themselves, and to search for third party verification of claims of sustainability, safety and quality. There is a distinction between first party organisations that have an immediate interest in the product, secondary organisations that have an association with a product, and third party organisations that have no interest in a particular product. In general, environmental assessment methods have similar goals, organisational structures and operating procedures. The programmes are voluntary rating systems that were created to promote sustainable design and performance of buildings. The main targets of the assessment programmes include promoting sustainable practices and identifying a common sustainability language and standards of measurement. The programmes are reviewed continuously for improvement so that they can be updated with the newest materials and procedures in the sustainable industry (Winchip, 2007).

The criteria of the credit categories concentration on reducing contamination and building reduced life cycle impacts; enhancing indoor environmental quality and the health and wellbeing of people; and preserving energy, water, raw materials, biodiversity, and land. The credit categories are developed in a collaborative process with the assistance of professionals from many organisations. These reflect best principles, practices and standards. Each credit category has a maximum number of available points. For example, up to three points could be awarded to a design that has good levels of daylight for users of the space; the total number of points awarded to a building determines the level of certification. Most systems have three to four levels of certification. Crediting organisations rate buildings by type of structure, such as new construction, existing building, and commercial interior: office, home, retail, industrial, school, and health (Winchip, 2007).

The assessment tools aim to prompt the designer and building industry to ensure environmental sustainability. There are several assessment tools such as BREEAM (England), SBTool (International), LEED (USA), Eco Profile (Norvey), Promise (Finland), Green Mark of Buildings (Singapore), Green Star (Australia), and CASBEE (Japan). Among these, the most internationally applied assessment instruments are BREEAM and LEED. BREEAM is widely used in the UK and globally, which was founded in 1990 by Building Research Establishment. BREEAM assessment method assesses the building regarding sustainability covering nine primary topics:

1. Management: in the dimension of site administration policy.

2. Health and wellbeing: factors concerning health and welfare.

3. Energy: energy depletion and gas emission.

4. Transportation: transport in the meaning of location and gas eruptions.

5. Water: performance in water consumption.

6. Materials: an evaluation of the features of a material life cycle.

7. Waste: wear products.

8. Land management and ecology: preservation of natural sites.

9. Contamination: air and water polluting evaluations.

(Rider, 2009)

Rating methods are designed in a way that breaks down the concerns of green building design and construction into something convenient – that is, into standards that an architect, designer, supplier, or anyone else in the construction sector can easily understand. The rating systems address all of the issues that design and construction industry professionals deal with on a daily basis, cross-referenced with the larger issues of sustainability (Rider, 2009).

Salman et al. (2011) note the proliferation of rating systems currently employed throughout the world, all utilising similar criteria but subtly different in how they work: e.g.: the United Kingdom's BREEAM; Germany's DGNB Certification Scheme; Canada's LEED; India's IGBC Rating Scheme and LEED India, and the United States' LEED. Most of the primary criteria of these rating schemes are alike in that they assess a building's energy depletion, water efficiency, material usage and indoor environmental quality. The BRE environmental assessment method (BREEAM) provides a rating system for new and 'in-use' buildings relating to sustainability, and they have their own framework for exterior and interior materials for rating buildings (BRE Global, 2012). This is the organisation that gives the most accreditation to sustainable buildings in the UK. Based on this, BREEAM will be the primary consulted reference together with LEED U.S Green Building Council to build a specified framework for sustainable interior design materials for luxury hotels.

Using an evaluating system provides designers, constructors and landlords with a metric to verify the applicable sustainability of their buildings. Targeting a level of sustainability applying an identified rating system can support ensure that the primary targets are maintained through construction completion. As a project progresses, the budget, plan, and other requirements can threaten to undermine the best intentions. When achieving a level of certification is an agreed-on priority, sustainable characteristics are less expected to fall by the wayside (Reeder, 2010).

The British BREEAM system is the world's first established method for assessing the environmental performance of buildings. The BREEAM method succeeds because of "its unique ability to cover a range of environmental issues within one assessment, plus presenting the results in a way that is widely understood by those involved in property procurement and management" (BREEAM, 2016).

2.3.5.1 BRE and BREEAM

The Building Research Establishment Environmental Assessment method (BREEAM) was established in 1990 and administered by Building Research Establishment Limited (BRE). BREEAM was the world's first sustainability assessment system for the built environment, and is managed and applied through a system of global operators, evaluators and industry specialists. It has added greatly to the strong effort in the UK on sustainability.

As BRE Global Limited's mission is to "Protect People, Property, and the Planet", BREEAM always try to work on increasing awareness between designers, owners, users, and engineers of the advantage of adopting a life-cycle approach to sustainability. It also assists them to take solutions successfully and cost-effectively. Within its application and use, BREEAM supports clients' measure and decrease the impacts of their buildings and in doing so, produces higher-value, lower-risk assets that are beneficial for people and the environment (BRE, 2012).

Barlow (2011) states that BRE has constantly sponsored BREEAM as an operator for revolution, and the sustainability performance models required to achieve BREEAM ratings have indeed risen over the years. In addition, BRE (2012) clarifies that BREEAM is supported in individual countries by some national scheme operators (NSOs). NSOs are self-governing organisations who develop and own country-specific regional systems that are affiliated to BREEAM.

To date, BREEAM has been applied to certify over 564,000 building, over 2 million buildings have been registered to be assessed by BREEAM, and it is being applied in 77 countries (BRE, 2018). In simple terms, it is a way to measure the environmental impact of an asset in the built environment, and to support sustainable practice (BRE, 2012).

- **The BRE Environmental Assessment Method (BREEAM)**

BREEAM assessment is undertaken for different reasons, such as being a requirement of the client to meet their corporate social responsibility objectives. Before 1996, there was little available, reliable or methodological robust guidance available for specifiers attempting to reduce the environmental impacts of building materials. Much of the relevant research and knowledge at that time gave either generalised advice, usually unsupported by quantitative data, or various statistical assessments that showed difficulty for designers and clients to understand. From there, the first release of the Green Guide was issued and intended to provide a simple model to the environmental impacts of building materials which were both easy for busy specialists to use and soundly based on numerical data. It was dedicated for use with whole-building evaluation tools such as BREEAM, the Code for Sustainable Homes and Eco Homes rather than as a stand-alone instrument. Material selection and specification influence the overall environmental, social and economic impact of a building, which the Green Guide cannot take into account.

For this reason, BRE Global does not advise that targets based on the Green Guide ratings are set separately, for example by planning authorities. The second version of the Green Guide was issued in 1998, and was launched by the minister for construction, and included over 200 specifications. Since that time, the Green Guide has been part of the BRE Environmental Assessment Method (Anderson, et al., 2009). The Green Guide divided the floor finishes into three basic groups: hard floor finishes, resilient floor finishes and carpeting. The Green Guide was produced to help provide designers and specifiers with a better understanding of the impact of materials after they decide on the acoustic performance, wear performance, This was based on the environmental profiles produced for each material. The environmental profiles scheme was launched in 1999 with financial funding from the UK government and the support of the construction product sector. The

environmental profile schemes are based on the life cycle assessment (LCA) of the UK construction materials provided by industry and assessed by BRE. These environmental profiles data have been used to inform the manufacturers about construction materials through post-assessment environmental profile reports, by showing their materials impact during production. Fowler and Rauch (2006) revealed that BREEAM has some limitations like the difficulty in obtaining detailed information about the system and can be accessed through BREEAM assessors as well as the process and rating system information are not clearly understood.

- **The environmental profile scheme**

In 2002, the environmental profile scheme was introduced to individual manufacturers to highlight the environmental profiles of their products. See Figure 2-10 for an example of a carpet environmental profile. In 2004, a major update of the original LCA methodology was commenced with the support from the BRE trust, reviewing assessment methods, normalisation and weighting, and most aspects of methodology (Dutfield et al., 2011). The environmental profile methodology developed a set of 'product category rules' (PCR) to apply LCA to the materials' environmental life cycle. The PCR is a set of procedures that need to be followed to make sure the developed LCAs are fair (Dutfield et al., 2011). The environmental profiles methodology evaluates impacts using 13 categories of environmental destruction, as shown in the examples in Figure 2-14.

As shown in Figure 2-14 the generic 13 categories of the environmental profiles, these 13 categories are hard to understand by designers or even manufacturers; therefore, BRE developed an Eco-point system, which is a single score that ranks the total impact of the 13 categories – the more Eco-points, the more significant the environmental impact of a material. These Eco-points are described by using A+ to E in the *Green Guide* as specifications; A+ is the lower environmental impact of a material and E is the higher impact of a material (Dutfield et al., 2011).

The 13 environmental impact categories used by the environmental profile methodology and the issues that they represent are presented in table 2-4:

Environmental impact category	Environmental issue measured
1- Climate change	Global warming or greenhouse gas emission
2- Mineral resource	extraction Metal ore, mineral and aggregate consumption
3- Human toxicity	Pollutants that are Toxic to humans
4- Nuclear waste (higher level)	High and intermediate-level radioactive waste from nuclear energy industry
5- Waste disposal	Material sent to landfill or incineration
6- Ecotoxicity to freshwater	Pollutants that are toxic to fresh water ecosystem
7- Stratospheric ozone depletion	Emissions of gases that destroy the ozone layer
8- Water extraction	Mains, surface and groundwater consumption
9- Photochemical ozone creation	Air pollutants that react with sunlight and NOx to produce low level ozone
10- Fossil fuel depletion	Depletion of coal, oil or gas reserves

11- Ecotoxicity to land	Pollutants that are toxic to terrestrial ecosystems
12- Eutrophication	Water pollutants that promote algal blooms
13- Acidification	Emissions that cause acid rain

Table 2-4 environmental impact categories and issues. Source: Anderson et al. (2009)

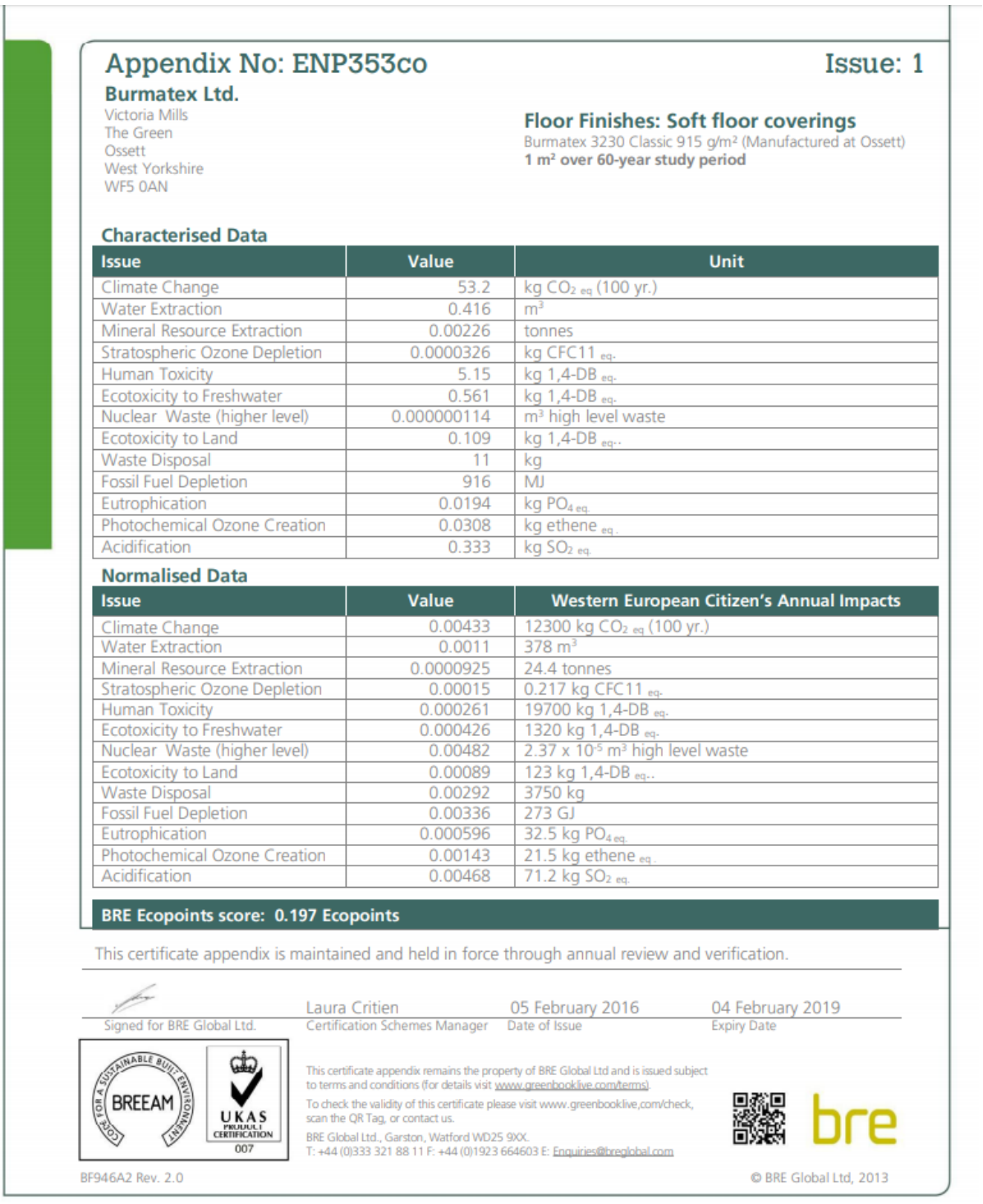
Ratings of environmental profiles are based only on product performance within each respective element group, for instance; its meaningless to compare concrete floor and a paint (Anderson et al., 2009). The environmental profiles cover building materials of ground floors, upper floors, roofs, external walls, windows, internal walls and partitions, insulations and landscaping. Across these building elements the environmental profiles provide an extensive, but not complete building materials. Therefore, materials environmental profiles will increase with each edition updated by BRE (Anderson et al, 2009).

Anderson et al. (2009) states that the environmental profile of a building material is one of many factors that need to be taken into consideration when compiling a specification, where cost, appearance, durability, maintenance, availability and function and operational issues are not covered yet by BRE environmental profiles. Anderson et al. (2009) emphasizes on compiling the environmental profile of materials with the other mentioned before specifications in the early stages of the project to produce a better building and environment.

The main objective of an environmental profile for construction material products is to provide a measurable and verifiable input for the assessment of the environmental performance of buildings as well as for interested parties to compare the environmental impacts of different construction products as they are used within a building, based on units of equivalent functionality (BRE, 2008).

Where the impact categories are in different units, it is difficult to see which categories are causing the most impact, therefore, BRE undertaken the normalisation in the environmental profiles where the reference information is the impact of a European citizen over a year. The normalised impacts are an easily understandable quantity for the user. Normalisation data is based on inputs and emissions from goods manufactured in Europe. Since the normalised data are different for each category, weightings are used to create an Ecopoint score in the environmental profile, a single score for overall environmental impact. 100 Ecopoints are equivalent to the environmental impact of one western European citizen for one year (BRE, 2008).

In the UK, materials section consumes around 30% of all UK energy. The building materials environmental profile (LCA) provided by BRE is one of many factors that should be taken into consideration when specifying a material, along with other factors such as cost, appearance, durability, buildability, availability, function and operational issues and development control issues. Designers should be aware of recycling and how recycling may not always express the best environmental practice, mainly where high cost and contaminating energy resources are utilised to recycle low-value material (Anderson, et al., 2009).



Appendix No: ENP353co

Issue: 1

Burmatex Ltd.

Victoria Mills
The Green
Ossett
West Yorkshire
WF5 0AN

Floor Finishes: Soft floor coverings

Burmatex 3230 Classic 915 g/m² (Manufactured at Ossett)
1 m² over 60-year study period

Characterised Data

Issue	Value	Unit
Climate Change	53.2	kg $CO_{2\ eq}$ (100 yr.)
Water Extraction	0.416	m^3
Mineral Resource Extraction	0.00226	tonnes
Stratospheric Ozone Depletion	0.0000326	kg CFC11 $_{eq.}$
Human Toxicity	5.15	kg 1,4-DB $_{eq.}$
Ecotoxicity to Freshwater	0.561	kg 1,4-DB $_{eq.}$
Nuclear Waste (higher level)	0.000000114	m^3 high level waste
Ecotoxicity to Land	0.109	kg 1,4-DB $_{eq.}$.
Waste Disposal	11	kg
Fossil Fuel Depletion	916	MJ
Eutrophication	0.0194	kg $PO_{4\ eq.}$
Photochemical Ozone Creation	0.0308	kg ethene $_{eq.}$
Acidification	0.333	kg $SO_{2\ eq.}$

Normalised Data

Issue	Value	Western European Citizen's Annual Impacts
Climate Change	0.00433	12300 kg $CO_{2\ eq}$ (100 yr.)
Water Extraction	0.0011	378 m^3
Mineral Resource Extraction	0.0000925	24.4 tonnes
Stratospheric Ozone Depletion	0.00015	0.217 kg CFC11 $_{eq.}$
Human Toxicity	0.000261	19700 kg 1,4-DB $_{eq.}$
Ecotoxicity to Freshwater	0.000426	1320 kg 1,4-DB $_{eq.}$
Nuclear Waste (higher level)	0.00482	2.37×10^{-5} m^3 high level waste
Ecotoxicity to Land	0.00089	123 kg 1,4-DB $_{eq.}$.
Waste Disposal	0.00292	3750 kg
Fossil Fuel Depletion	0.00336	273 GJ
Eutrophication	0.000596	32.5 kg $PO_{4\ eq.}$
Photochemical Ozone Creation	0.00143	21.5 kg ethene $_{eq.}$
Acidification	0.00468	71.2 kg $SO_{2\ eq.}$

BRE Ecopoints score: 0.197 Ecopoints

This certificate appendix is maintained and held in force through annual review and verification.

Signed for BRE Global Ltd. | Laura Critien, Certification Schemes Manager | 05 February 2016, Date of Issue | 04 February 2019, Expiry Date

BF946A2 Rev. 2.0

Figure 2-14 a sample of a carpet environmental profile. Source: BRE (2016)

2.3.6 Eco tools and guidelines

When materials are assembled as components of a product, a probable starter for manufacturers utilising Eco-Design is to develop white, grey and blacklists for materials employed in the production of commodities. Whitelists contain elements that should be applied. Grey lists include materials that might be used if there is a good reason and blacklists contain substances that are forbidden. Unfortunately, such material evaluations usually do not support data about the environmental performance of the materials, when they are mixed in a product. Hence, dealing with the idea of the best green materials logically is vague (Allione, et al., 2012). A lot of variables have to be acknowledged during the design process: this cannot be centred just on the best environmental material option, but should also concern the product configuration, its usage setting and its end of life (Allione, et al., 2012).

As a consequence, this means choosing materials that can maintain the highest rate of material or energy, with a consequent increase of the material lifespan. In practice, many factors have to be counted through the material selection: this can complicate the material selection stage, where the designers play a vital role because this choice has to be intimately related to the several requirements that have to be satisfied by the life cycle of the product. In other words, the final material choice should be based on the decisions taken along the design process, where all product demands and requirements are outlined, and the material tasks are set. (Allione et al., 2012).

In theory, selecting an eco-product from a designer's perspective proposes utilising a methodical and anticipative approach to the full product lifecycle, in order to learn the different activities and the various energy and material flows which are included in the production, usage and distribution stages of the materials. On the other hand, throughout the product and the concept design, in practice, the designers usually select materials

based on the technical and financial performance. This is because they only have incomplete knowledge of the environmental aspects that could compromise the product performance and about the background of the LCA impact indicators. Besides, designers frequently choose a material on the basis of their understanding of conventional materials and not on the real opportunities offered by innovative materials, which are continuously put on the market (Allione et al., 2012).

Allione et al. (2012) argues that material considerations are important not just in the sustainable characteristic of the materials themselves, but also in gathering all materials into building components that work together to create a sustainable option.

Regarding RSMeans (2011), there are two groups of standards, guidelines and rating systems related to buildings: those that relate to the whole building and those that relate to specific components within the building. The LEED rating system is an example of a whole-building (multiple-attribute) rating system while ENERGY STAR is an example of a rating system focusing on a specific component of the building (single attribute). Allione et al. (2012) explain that Eco-tools have been created to support designers through the design procedure to achieve an eco-product; these Eco-tools are based on the analysis of the environmental performance of these products or materials. There are two kinds of Ecotools: quantitative and qualitative. The quantitative tools are based on a theoretical background of LCA and on the phases of LCA; these tools provide and identify the main impacts in relation to the environmental consequences. The qualitative Ecotools such as guidelines, material library and eco-strategies provide designers with general or specific material information and their production or they provide designers with best practices suggestions which can be followed to minimise the environmental impact of a product or a material throughout the life cycle phases or through a specific phase (Allione et al., 2012).

According to Allione et al. (2012), quantitative Eco-tools are not beneficial through the concept and product design where designers are directly involved, due to the large

amount of data needed to run a life cycle analysis which are not available in the concept stage; additionally, LCA is a time-consuming process. Conversely, the qualitative Eco-tools such as guidelines are able to guide designers and lead them through the concept and product design steps, enabling designers to make the right environmental decisions. These guidelines, according to Allione et al. (2012), focused on three categories and guidelines of the material selection phase to help designers make the right choice. These three categories are: materials with low environmental impact, extension of the material end-of-life phase, and ethics and strategies of the material manufacturer, as shown in Figure 2-15 (Allione et al., 2012).

Allione et al. (2012) used the combination of qualitative and quantitative guidelines and added the sensory profile of each material using; view, touch, hearing and smell. To help

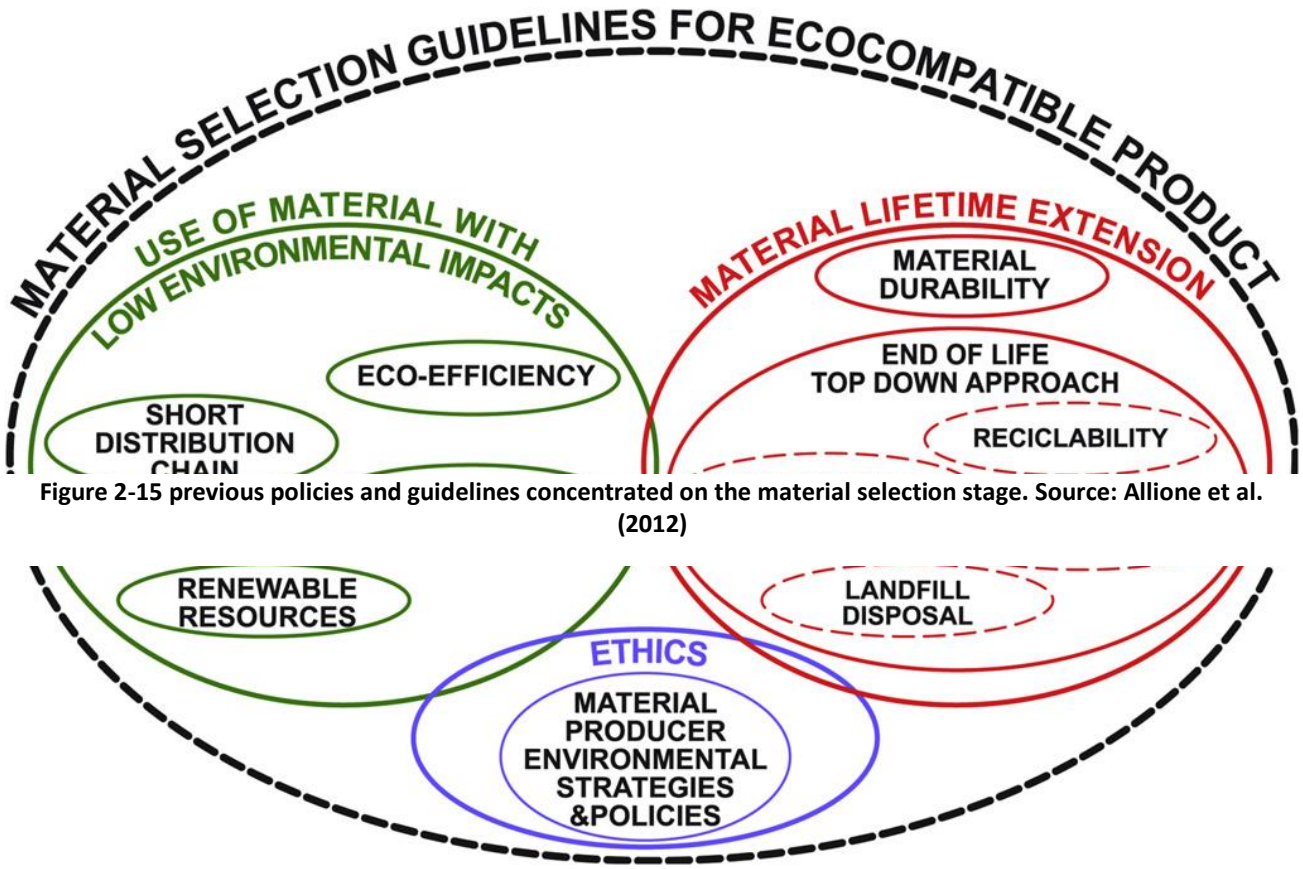


Figure 2-15 previous policies and guidelines concentrated on the material selection stage. Source: Allione et al. (2012)

designers know the details of the materials and how it looks like. See figure 2-16 an example of Allione et al. (2012) environmental and sensory performance of a material. Allione et al. (2012) offered these material profiles as a consultancy service to help designers with their choices. These profiles developed by Allione et al. (2012) are not available for public, and payment is required to access their materials profiles.

As far as we know, no previous research has investigated the luxury criteria of material finishes of a high-end hotel, most of the sustainable building guidelines focused on construction materials regarding the environmental impact only.

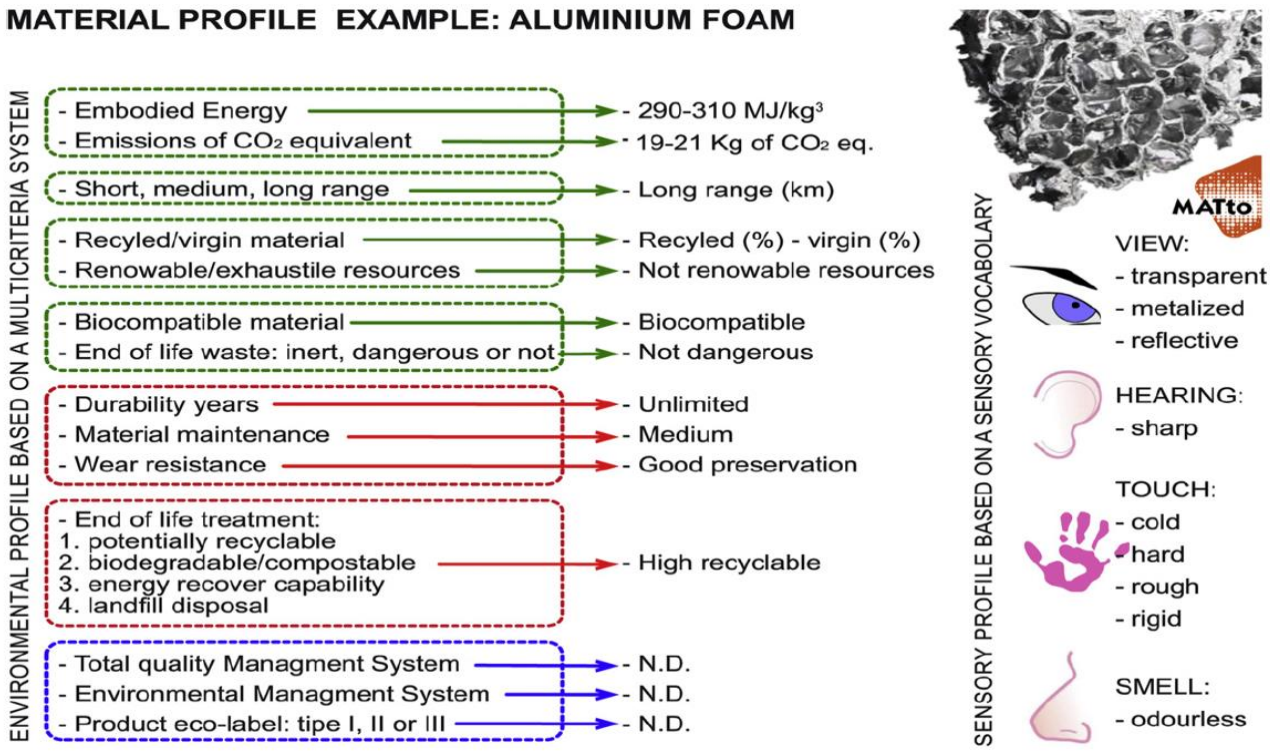


Figure 2-16 environmental and sensory profile of aluminium. Source: Allione et al. (2012)

- **Summary table of sustainable, luxury and guidelines related to carpets:**

Sustainable carpets	Luxury carpets	Guidelines and eco-tools related to carpets
Zero or low VOCs materials	Superior materials like animal hair or silk	GUT
Carpet tiles	High thickness value	BREEAM and BRE environmental profiles
	Tufted carpet	

Table 5 sustainable, luxury, and guidelines related to carpets

2.4 Luxury and sustainability

"As consumers become more environmentally and socially aware about the choices they make so hoteliers are responding by creating eco-aware hotel interiors that they hope will attract a new generation of responsible guests" (O'Neill, 2011).

Luxury has lately been a target for public criticism: it is delaying with, if not at odds with, sustainable development imperatives. Concentrating on particular products and users, critics point to the consumption of resources for the enjoyment of a happy few. Luxury invites specific attention as, beyond ecology, sustainable development talks about social equity (Kapferer, 2010). However, Kapferer (2010) stats that, now a more in-depth investigation shows how much sustainable development is genuinely agreeable with luxury. In his opinion, both, luxury and sustainability take rareness as their primary concern, and real luxury is by description durable. Adding that, luxury highlights the inequality of community, but it does not create it. Serving as a paragon of excellence, luxury will need to serve as a model in sustainability. All primary real luxury labels have

already reacted to the interests of sustainability, but without much interaction with each other (Kapferer, 2010).

Sustainable development has become the main common challenge for all nations on our planet. Although not all of them approved the Kyoto Agreement, most of them are concerned about the consumption of our natural resources and the urgency to find a different type of economic growth, bringing into account the costs of its collective adverse fallout, so far unmeasured, which bear down on future generations. Sustainable development (SD) is a global concept promoting a community that can persevere over generations. As a result, it should make reasonable uses of the planet's resources (physical, human, biological). Beyond ecology, sustainable development advocates the conservation of biodiversity, of natural resources, and is also concerned with social equity. At the extreme, some advocates of sustainable development consider that growth in itself is the obstacle (Kapferer, 2010).

The growth of the luxury market, and the increase in its consumer base, has opened up the luxury market to criticism, with critics pointing to the consumption of resources and how these are wasted just to make a few people happy. Luxury brands are considered as a symbol of the high-consumption society which is controlling the world (Kapferer, 2010).

In 2004, the United Nations World Tourism Organization (UNWTO) defined sustainable tourism as an enterprise that achieves an effective balance among the environmental, economic, and socio-cultural aspects of tourism to guarantee long-term benefits to communities (De-Miguel-Molina, et al., 2012).

Ahn and Pearce (2013) argue that hoteliers aspire to be ecologically responsible, both for economic and financial profitability, and to please their own personal morals. In hotels

which seek sustainability, there is always a conflict between the comfort and satisfaction of hotel guests and green building practices. This fashion towards sustainable hotels is not only limited to addressing environmental concerns by saving water, energy and resources but also to increase the comfort and satisfaction of guests; guest pleasure, intent to return, and the possibility to recommend a hotel are essential factors for success in the hospitality sector. Accordingly, designers generally focus on areas identified to be strongly linked to these factors, particularly the lobby, the guest rooms, the bathrooms, food and beverages, spas, the external environment, and the artwork presented around the hotel (Ahn & Pearce, 2013).

Although the shift towards sustainability within the hotel sector, many hospitality professionals lack a firm knowledge of how sustainability and luxury might match together in the built environment, and how the sustainable choices they take influence the indoor environment and subsequently the hotel guests. Sustainable design is usually presumed not to be attractive and comfortable (Mclennan, 2004). The design, style, comfort and wellbeing of a hotel's built environment influence the guests' selection of the hotel (Heide & Gronhauge, 2009).

Kasim (2004) argues that achieving a balance between an exceptional guest experience and a sustainable hotel would open new opportunities for business endeavours. Therefore, Ahn and Pearce (2013) focused in their study on developing a better understanding of how to achieve the goals of sustainability in a hotel while sustaining a luxury environment for the guests' satisfaction in terms of the construction materials as well as the electricity and water consumption.

Durability is the opposition of the fashion business and the mass market industry, based on planned obsolescence. On the contrary, luxury is the profession of lasting value. Luxury is by interpretation durable. On the contrary, luxury is the business of continuing worth (Kapferer, 2010).

Just as sustainability seems to be multi-faceted, luxury has multiple sides as well. Academics and practitioners have suggested many definitions of luxury. This large number of definitions emerges from the reality that they often reflect individual perceptions of luxury rather than trying to define the concept (Kapferer & Michaut, 2010). Instead of adding another definition, Barnier et al. (2012) found from the previous studies and re-analysis of three well-known scales measuring luxury, and identified the seven common elements characterising luxury, as they emerge from the three primary measures adopted to date: outstanding quality, indulgence (beauty and joy), cost (expensive), rarity (which is not scarcity), selective distribution and connected personalised services, private character (fame, privilege), and creativity (art and avant-garde) (Barnier, et al., 2012).

Luxury can lead the way by redefining the concept of quality and the luxury vision, no longer a self-centred individual one, but one that brings into account environmental attention. To remain a leader versus mass goods, and in fashion, luxury will have to be sustainable in cultural, commercial and ecological terms. It is formed in its genes and business design. As a consequence, luxury groups will put stress upon their providers and distributors to stimulate behavioural changes and adjust faster with SD measures. By doing so, they will play a leading part in the redefinition of the modern hero. The wealthy class of tomorrow, by their conspicuous selection of luxury brands, will demonstrate not only their affection and wealth but their sense of discernment and altruism (Kapferer & Michaut, 2010).

Spiegle and Meadows (2012) explain that building owners usually have an ugly imaginary associated with the environmental term, and they think that sustainability and aesthetic cannot meet. Also, Spiegle and Meadows (2012) add that aesthetic satisfactoriness is subjective where it depends on personal opinions, explaining that some building owners found green materials more attractive and elegant than conventional ones, while other building owners found the same green materials are less attractive than the conventional one.

2.5 Sustainability and luxury within the London hotel industry

In the UK, there is a need to deliver a sustainable built environment. However, the government has been advocating the development of a sustainable built environment. It has encouraged sustainable organisations, individuals and designers to build sustainably by establishing a UK Sustainable Development Strategy, which identifies that everyone has the right to a healthy, clean and secure environment. Different organisations for the sustainable environment are leading programmes to achieve and rate sustainability, to design sustainable societies, decrease energy, assure that sustainable building materials and systems are used and support private-sector interest in sustainable building like BREEAM (Williams & Dair, 2007). Moreover, the UK has set a plan to decrease Co2 emissions by 60% by 2050. (Rotimi et al., 2017).

In the first eight months of 2015, a 10% rise in overseas trips lead to a fast-growing travel market, with average spending also rising. The potential consumer market for luxury travel is growing (Mintel, 2015). See figure 2-17.

According to the World Luxury Index issued at the first Luxury Hospitality summit taken place in Switzerland in June 2013, London is one of the world's fastest-growing cities for customers seeking a luxury hotel experience. International and national investors are always willing to invest in London and Paris for a good reason, as Euro Monitor International ranked both cities as the first and second top 100 destinations with approximately 15.5 million guests annually to London, and approximately 9.8 million to Paris (Mayes, et al., 2014). London has been related with luxury tourism and high-class

Figure 2-17 overseas holiday market volume, annual growth of 2009-2015. Source: Mintel (2015)

hospitality, which has been linked with the rapid spread of the global wealth that has raised interest in luxury accommodation in London. Locations such as Mayfair and Knightsbridge in London are known as the location for luxury hotels; although these hotels are located in existing old buildings, London is still seeing new-build hotel development. Almost 8 million tourists stayed in London in 2012, which is equal to the London population. London is one of the most famous destinations for luxury shopping and Bond

Street is known as the most expensive shopping street in the world (Mayes, et al., 2014). See Figure 2-18.

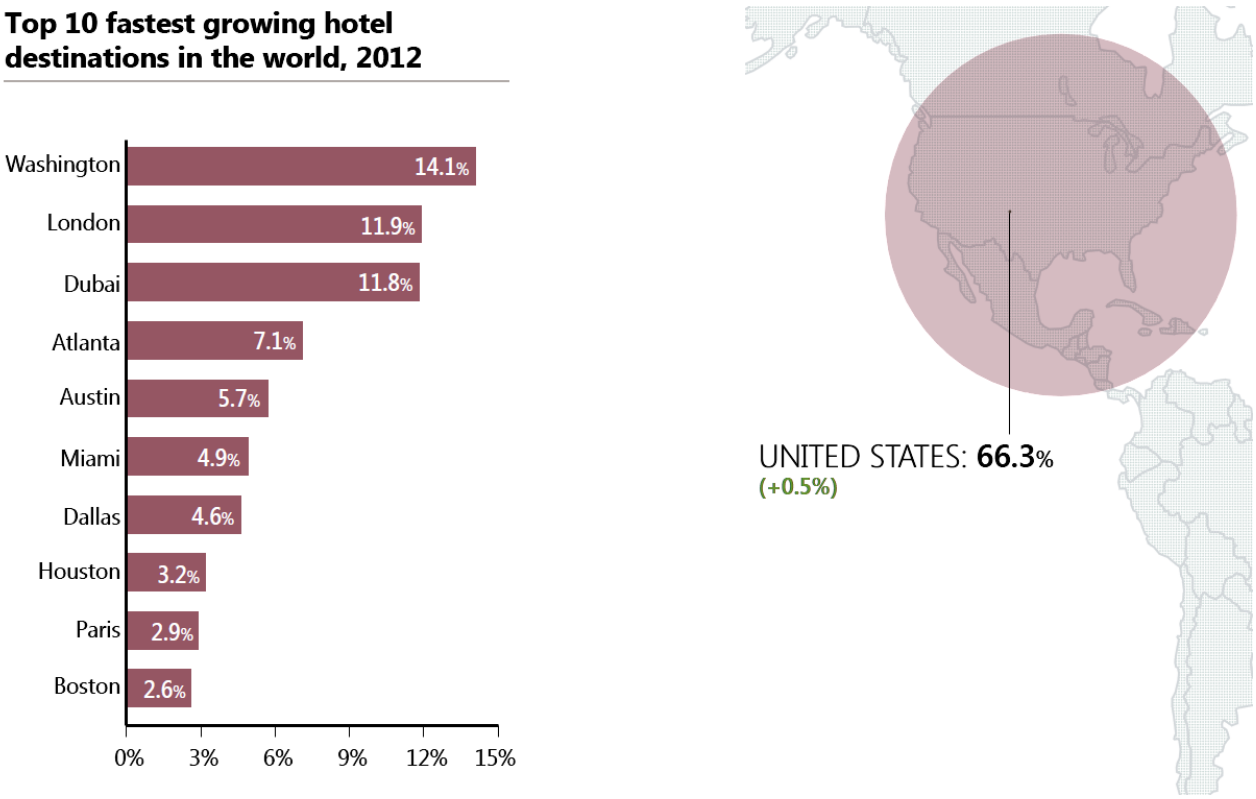


Figure 2-18 growth in guest interest for luxury hotels in 2012. Source: the world luxury index hotels (2012)

The hotel industry is a dynamic part of London's growing tourism industry. London's prosperous and various cultural offerings are pulling in guests in record numbers. The capital is home to four world legacy locales, eight imperial parks and the greater part of the UK's top ten vacation spots. London's hotel market is the most lucrative hotel market in Europe and is attracting investors from all over the world, both domestic and international. As reported by the MasterCard Global Destination Cities Index 2015, London remains the world's top-ranked stop with 18.8 million global guests in 2015 (SU & SUN, 2007).

There are different hotel grading systems in the UK; the famous ones are those of the English Tourist Boards (ETBs), the Automobile Association (AA), and the Royal Automobile Club (RAC) (SU & SUN, 2007). The ETBs system includes the cooperation of ten local tourism authorities to achieve a national hotel rating system (including Scotland and

Wales). The ETBs group is responsible for checking the accuracy of and persevering confidence in the hotel rating system. The hotel ranking system used by the ETBs is divided into two sections: facility classification and quality rating. Quality grading is a qualitative evaluation of precise equipment or level of luxury on a one to five crowns scale. Then for each of those operating levels, the ETBs further indicate a quality rank of (from bottom to top) 'approved, commended, highly commended, or deluxe' (SU & SUN, 2007). The crown classification for the building is separated from the assessment of its service quality. The initial research regularly includes an investigator visiting overnight as a regular guest. The inspector will not unveil his or her identity until the bill is paid the next morning. A high proportion of subsequent inspections also require an overnight stay (SU & SUN, 2007). The quality evaluation covers such aspects as the warmth of hospitality and efficiency of service as well as the type of the furnishings, fixtures and décor. The type of meals and their presentation is examined, as is anything that might influence the guests' experience. Investigators are thoroughly trained to implement the quality standards consistently and honestly. The inspectors view only those facilities and services that are provided, and due attention is given to the style and nature of the facility (SU & SUN, 2007).

Consequently, facilities such as B&Bs, farmhouses and guesthouses are not required to operate in the way of large city-centre hotels to obtain a high-quality ranking. This implies that all kinds of establishments, whatever their classification, can achieve a high-quality class for the amenities and services they offer. However, the quality rank does not involve an evaluation of value for money. The data provided by the combination of the classification and quality rank allows members of the public to decide for themselves what represents good value (SU & SUN, 2007).

When conducting quality evaluations, investigators compare the standard of what is presented for each individual character of the operation against standards set down by the ETBs. These standards are based on the experience of investigating more than 11,500

facilities a year. The quality of each individual features is evaluated as excellent, good, acceptable, or poor. The investigators recognise variations within these groups. The highest assessment is provided where it would be unreasonable to expect anything significantly better. The quality rank granted to an establishment reflects the overall performance on the individual aspects. It is a balanced view of what is presented and, as such, cannot recognise different areas of excellence. Following each ranking investigation, the inspector explains his or her findings with the owner or manager but does not state the grade at that time. The evaluation of the inspector is ruled to further analysis and checks before a report confirms the class. The rating may not be applied until the approval letter has been received. With the confirmation letter comes a copy of the written evaluation form with a history of the notes made at the time of the inspection. These notes are meant to be helpful to those who wish to enhance their standards or obtain a higher grade (McGivney, 2015).

2.6 Chapter summary

This chapter provided an overview of luxury and sustainability and the connection between them within the high-end hotel industry, with a focus on London as the research location. Moreover, this chapter provided an insight into luxury hotel specifications, sustainable interior design and material finishes, environmental assessment tools, and Ecotools and guidelines. It highlighted the need to develop a guideline which combines specifications for luxury and sustainable material finishes to guide designers in selecting a luxury sustainable material for a high-end hotel guestroom, and also to encourage hotel owners to adopt sustainability within their luxury hotel interior design.

Moreover, the chapter revealed that despite the literature on the luxury market, only a few studies within the interior design and hotel context have mentioned or defined the term ‘luxury’, and mostly in an indirect way; most of the previous studies on luxury have

focused on economic, marketing and management aspects. Few studies have been conducted on hotel interior design material finishes in terms of luxury, while all the studies related to luxury hotels have focused more on luxury service.

Another main aspect of this chapter focused on the difficulties of defining luxury and that this difficulty arises from its subjective character. Besides, the growth of the luxury sector and the increase of its audience has subjected 'luxury' to constant criticism due to its increased level of consumption of resources. Therefore, luxury hotels have started following the sustainability trend by adopting sustainability in places where it saves them money, considering the financial aspect only with the assumption that sustainable hotels are unattractive.

This chapter revealed that hotel guests are more aware about the environment and show an interest in sustainable hotels. Hence, designers play an important role in designing sustainably. However, although designers show an interest in designing sustainably, their practices are driven by clients and they lack knowledge of sustainable materials. Also, a large group of designers and architects complain about the absence of rich, complete, accessible data in the area of selecting sustainable building materials for interior design (Godsey, 2017).

This chapter stressed the fact that as much as the buildings and human activities effect the environment, also the occupants of buildings are affected by the indoor environment of the building. The 'sick buildings' affect the health and wellbeing of occupants, and therefore impact their productivity. This was emphasised by BRE, who have shown that the material finishes and furniture of the indoor environment release VOCs that cause headaches, airway irritation, tiredness and burning eyes. They focused on flooring material finishes where they cover large areas of the building space and are made up of layers of different materials.

This chapter revealed that the rating systems and guidelines provided by organisations like BREEAM are not covering any material appearance specifications to encourage designers in selecting sustainable materials. Also, the environmental profiles awarded by BRE are only showing the environmental impact during the production of the material without covering the in-use period and its impact on the indoor environment. Moreover, revealed the two types of eco tools; qualitative and quantitative where the qualitative can be used in the design concept while the quantitative is hard for designers to apply it in the design concept.

The discussion in this chapter has provided the context for this research, which aims to develop a design guide to help designers select luxury sustainable material finishes for a high-end hotel guest room, taking carpet as a case study.

CHAPTER 3

Chapter 3: Research Methodology

3.1 Introduction

The topic of the current research incorporates a wide range of background material obtained through the literature review, resulting in the need to take a holistic approach towards answering the research questions and solving the research problems presented in Chapter 1.

The final research methodology was developed by making several changes. The researcher's original intention was to collect the primary data using interviews. However, limitations of this method included the inability to access hotels in Jordan, which was the first suggested research case study, and the struggle to interview designers in London in the second suggested research case study; this is explained in detail Chapter 1 as well as in a discussion of the research limitations in Chapter 7, section 7.7. In addition, after conducting the literature review, the researcher realised that there was a need to use existing data from BRE in creating the design guide, where the need for the research to rely on materials that have been given particular environmental profiles became apparent.

In constructing this particular methodology, the aim was to identify methods to answer the research questions, aims and objectives. This chapter presents the initial research methodology and how it was subsequently developed after facing difficulties and challenges in Jordan and then London, as alluded to above and presented in section 3.2.

This chapter consists of five major sections; section 3.2 explains the original methodology and how it developed. Section 3.3 presents an overview of the selected research methods: quantitative, qualitative and mixed methods. It also covers the research philosophies and paradigms, the research paradigm advocated, with a discussion of the advocated mixed-methods approach, the selected and rejected research methods, the research methodological approach and research design. Section 3.4 presents details about the

methods of data collection including a hotel guests' online questionnaire, interviews, an online questionnaire for designers, a case study, and a carpet test questionnaire. Information is also provided on the analysis of the data collected through these methods. The chapter closes with a summary in section 3.8.

Ultimately, a mixed-method approach was adopted (see section 3.3.4) in order to address the limitations in data obtained from a single approach as well as to cover the multidisciplinary nature of the research topic. The adopted method therefore addressed the gap in being able to obtain sufficient, quality data from a single method in order to address the research objectives. This chapter therefore explains the reasons for selecting each component method and how they were integrated into the overall methodology.

3.2 Original methodology and development

The original research methodology was subject to some alterations, as mentioned in Chapter 1 and section 3.1 of this chapter (see Figure 3-1). A qualitative approach was adopted in the original research methodology, based on interviews and case studies. This approach was influenced by the researcher's connections with designers in Jordan, which made it easier for the researcher to interview them, as well as the researcher's belief that hotels as a case study would be accessible. The original aim was for the research location focus to be Amman/Jordan to investigate how Jordan is slow in adopting sustainable building practices in comparison to western countries, especially within the hotel sector. Hussein (2011) stated that when considering materials and resources, the focus is on the well-being and productivity consequences of the material selection for the building occupants, and that this is more likely to apply in developing countries rather than developed ones.

The main focus of the current research was luxury hotels in Amman city, as the capital city of Jordan, Amman has many luxury hotels. Moreover, Jordan is experiencing development in the tourist industry, especially the hotel industry where the number of five-star hotels has increased in Amman (Ali et al., 2008; Haija, 2011). However, the luxury hotels in Amman declined to participate in this project as case studies, and refused any kind of participation due to security reasons following the 2005 coordinated bombing attacks on three hotels in Amman. Although the researcher provided luxury hotels in Amman with a formal letter signed by the supervisory team from De Montfort University, the hotel management still refused to participate, claiming that the decision did not come from the hotel management but from the Jordanian government authorities. Therefore, without any access to the hotel buildings or being able to interview the hotel managers and guests, it was impossible to investigate these hotels. This meant that the researcher could not continue with Jordan as the research location.

Subsequently, the researcher tried to find a solution in her current city of residence (Leicester/UK), thus avoiding the need to travel to any other country. However, identifying a five-star hotel in Leicester proved impossible, as it became apparent that there are none in any of the nearby cities, such as Nottingham and Birmingham. The researcher then considered London as the research location as London has a large number of luxury hotels, due to being one of the world's fastest-growing cities for guests looking for a luxury hotel experience (Mayes et al., 2014).

It proved difficult to obtain data from London itself due to the busy work life there as well as the privacy that luxury hotels provide to their guests, which presented challenges in interviewing or even simply administering a questionnaire to hotel guests (as mentioned in detail in section 3.7.1). Hence, the researcher needed to take measures to address this difficulty. In addition, interviewing designers in London also proved to be a challenge as most of them are very busy working on big projects (the researcher having targeted large design firms specialised in hospitality design), as explained in section 3.7.3. The majority of designers did not respond to my emails and only a few agreed to being interviewed, as explained in section 3.7.3. Therefore, the researcher needed to adopt an additional method to collect appropriate data from designers. Given these problems (with luxury hotels and with the designers of these environments), it became necessary to change the research methodology from a qualitative approach to one based on a combination of qualitative and quantitative methods. This was achieved by adding a designers' questionnaire to collect more data, administering it online to save time (see Figure 3-2). Similarly, a luxury hotel guest questionnaire was added to collect data, due to the refusal of hotel managers to give permission for data to be collected from their guests. Each method is explained in detail in section 3.3.

This study has a small sample size due to the limitations faced the researcher while adopting each method, the researcher kept the sample size of interviews, questionnaires, case study and test questionnaire in range of sample size numbers of previous studies. The luxury hotel guest questionnaire was under the range of previous studies, this due to the difficulties in having access to the luxury hotel guests emails in

London. Where luxury hotels managers in London protected their clients' privacy and refused to share their emails or even share the questionnaire with them, therefore the sample size is small, and this is explained in details in section 3.4.2.2. See table 3-1.

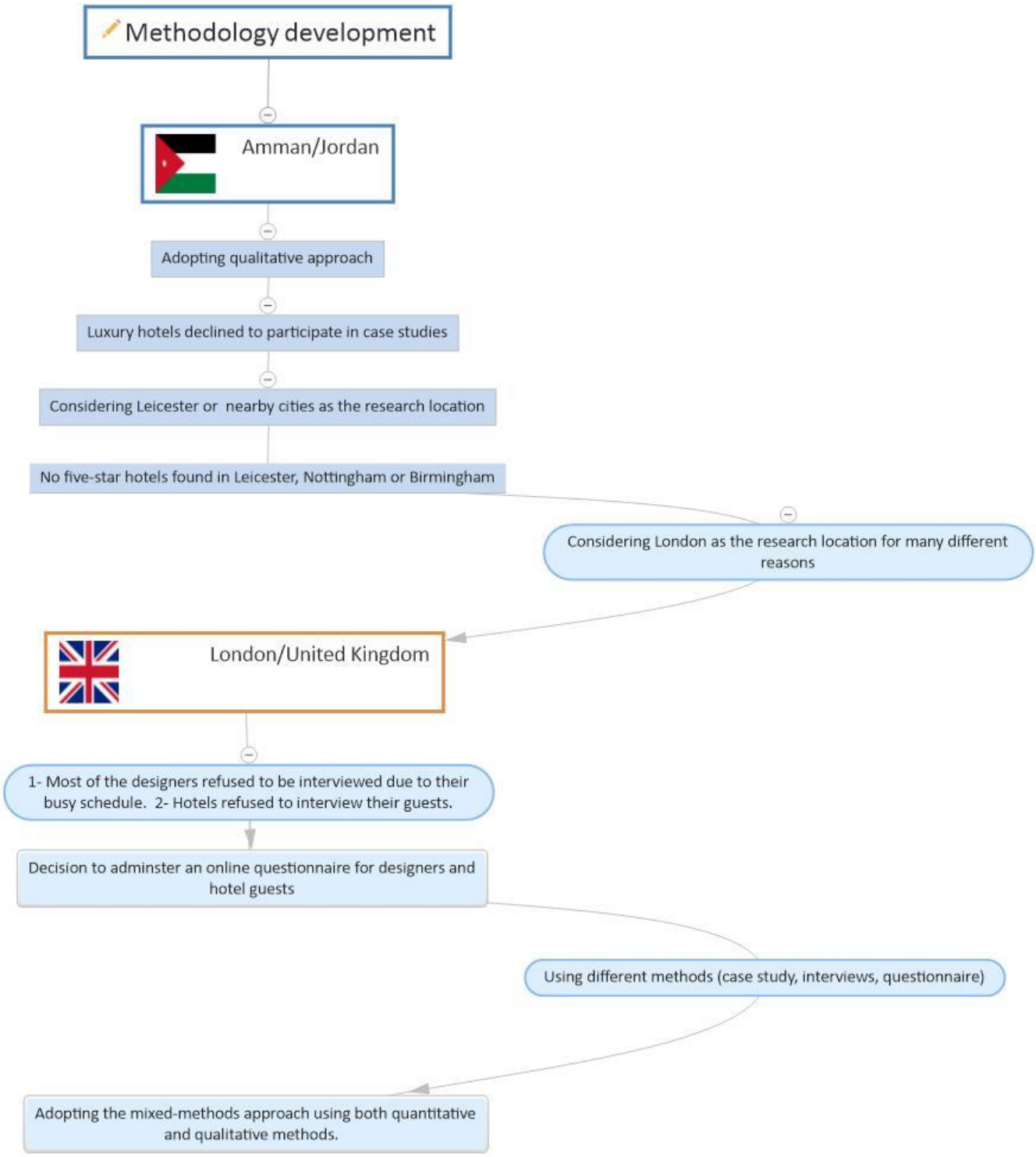
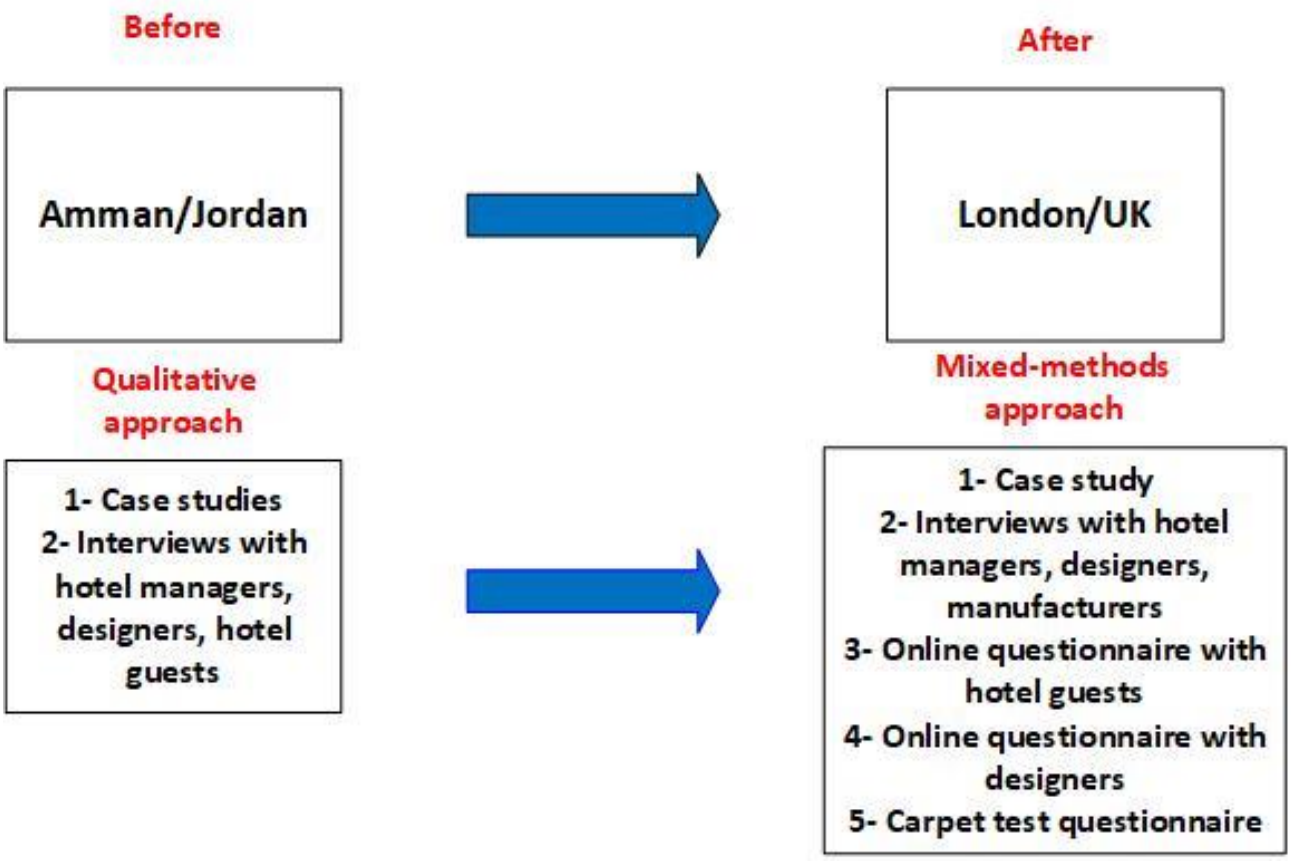


Figure 3-1 initial research approach and development. Source: author.


Before
Amman/Jordan
Qualitative approach
1- Case studies
2- Interviews with hotel managers, designers, hotel guests
After
London/UK
Mixed-methods approach
1- Case study
2- Interviews with hotel managers, designers, manufacturers
3- Online questionnaire with hotel guests
4- Online questionnaire with designers
5- Carpet test questionnaire

Method	Respondents	Sample size	Sample range in previous studies	Method of analysis
Designers Questionnaire	Architects, Interior designers	33	20-225	Microsoft Excel
Interviews	Designers (Architects and Interior designers), Hotel managers, Manufacturers, BREEAM	14	12-30	NVIVO
Case Study	5 star hotel/ London	1	1-32	Visual inspection

Figure 3-2 methodology development. Source: author.

Hotel guests questionnaire	Luxury hotel guests	12	455	Microsoft Excel
Carpet test questionnaire	Academics	25	20	Microsoft Excel

Table 3-6 research methods sample size with reference to previous related studies sample sizes. Source: author.

3.3 Research methods

This section presents an overview of the research methods and types, followed by a discussion of research philosophies and paradigms. Each type of research paradigm is explained, followed by a conclusion regarding the most suitable paradigm for this study. Additionally, a justification for the adopted methods and their selection is provided. Methods that were rejected due to their unsuitability for this research due to the time frame and budget are also discussed

It is important to highlight here that although the choice of methods was directed by the methodological challenges and difficulties faced, as mentioned above in section 3.2, the methods were nevertheless selected based on their suitability and appropriateness for the research time frame.

3.3.1 Overview of research methods

Kothari (2012) defined research as producing novel contributions to existing knowledge through study, observation, comparison and experimentation. Goddard and Melville (2007) argued that research is about generating data which is not currently available. However, Dane (1990) emphasised that the crucial goal of research is to develop questions and to seek answers to these questions through the research process. Therefore, research can be defined as a careful and organised way of enhancing knowledge through the exploration of the unidentified in order to confirm or gain new knowledge. Hence, this research seeks to find answers to the research questions presented in Chapter 1. To do so, it is important to discuss the various research methods and how these are related to this particular study.

Research methodology deals with the theoretical and philosophical consequences of choosing a particular research method (Seale, 2004). It aims to help the researcher to understand the process involved in conducting a scientific method of inquiry. The research method involves the process of collecting and analysing research data

(Dawson, 2002). It is an organised way of providing answers to the chosen research questions (Kumar, 2014; Sridhar, 2009). Research can be conducted through a wide range of methods (Steele, 2000; Groat & Wang, 2002). These methods are traditionally grouped into quantitative and qualitative approaches (Onwuegbuzie & Leech, 2006). Both quantitative and qualitative methods went through a historical era of growth leading the design of research in the social sciences between the late 19th century and the mid-20th century. In the first half of the 20th century, scholars showed attention in qualitative research, and alongside this there was a notable development in mixed-methods research (Creswell & Creswell, 2018). The combination of quantitative and qualitative approaches is termed mixed methods, which is considered as the third method of conducting research (Creswell, 2007; Johnson et al., 2007). Rajasekar et al. (2006) maintained that there are three kinds of research approaches: quantitative, qualitative, and mixed methods. The following sections discuss quantitative, qualitative and mixed-method research approaches, before turning to the selection of the mixed-methods approach in this study.

3.3.1.1 Quantitative method

The quantitative research approach has been defined as the use of natural science experiments to conduct scientific research (Henn et al., 2005). In quantitative research, the researcher principally adopts the post-positivist assertions regarding knowledge development (Creswell, 2013).It involves measurement of various aspects of social life (Blaikie, 2010).Researchers have revealed that the quantitative research method relates more to participants' attitudes elicited via large surveys rather than behaviours which are elicited via small-scale surveys (Brannen , 1992; Naoum, 2012). There are three major approaches to quantitative research: desk research, surveys and experiments (Creswell, 2003; Fellows and Liu, 2003). The survey approach has been employed extensively in social science studies using questionnaires or structured interview instruments in order to generalise the research output from the sample population to the entire population (Babbie, 1990) Other approaches include mail, personal and telephone surveys (Rubin & Babbie, 2013). Quantitative research deals majorly with statistics using experiments and questionnaire surveys to gather

numerical data for statistical analysis (Myers, 2013). Surveys are the most common method used in the quantitative data (Rubin & Babbie, 2012).

3.3.1.2 Qualitative method

The qualitative research approach is based on understanding and discovering the context of cultural and social science, and describing actions in a natural way (Creswell & Creswell, 2018). Qualitative research empathises with and identifies with people, in order to comprehend how they see things, where the main aim of qualitative research is to provide answers to why and how questions (Creswell, 2003). Also, it is known as inductive research, where it develops perceptions, beliefs and perceptions from patterns in the data rather than gathering data to assess fixed models, theories or concepts (Taylor, et al., 2015). Creswell and Creswell (2018) added that in qualitative research, data analysis is structured from specific to indefinite themes, and the researcher clarifies the meaning of the data. The qualitative approach can be constructivist, where the researcher looks to uncover the meaning of a phenomenon from participants' point of view; this involves observing a culture-sharing group and learning how it evolves shared patterns of behaviour over time. Observing participants is one of the main elements of data collection in this approach. The most common used methods in a qualitative research are focus group and interviews in addition to case studies (Henn, et al., 2005). The focus groups is usually used when the researcher interested to know how several people have a common or different views on the same topic (Henn, et al., 2005).

3.3.1.3 Mixed methods

In the mixed-method approach, the researcher tends to support knowledge claims based on pragmatic assumptions. Greene (2007) explained that the main idea behind conducting the mixed-methods approach is to diagnose the complication of the studied social phenomena, and in so doing, one involves with a number of theoretical perspectives and a bricolage of paradigmatic positions. Mixed methods strive to

combine both qualitative and quantitative research methods to produce more precise and robust information (Canales, 2013). Collins (2010) argued that the multiple or mixed-method approach employs research instruments from both qualitative and quantitative methodologies to answer research questions. Creswell and Clark (2011) described mixed-method research as a method that combines the collection and analysis of quantitative and qualitative data in one study or in a series of studies to produce a result that enables a better understanding to be reached of the research problem than is possible using a single method.

There are four types of mixed method approach: explanatory, embedded, triangulation and exploratory (Creswell & Creswell, 2018). The explanatory methodological design employs the subsequent use of methods with quantitative preceding where qualitative data is used to explain the quantitative findings (Creswell, 2006; Creswell & Creswell, 2018). The exploratory methodological design is the reverse way of the explanatory methodological design, as it uses different theories where the qualitative method was first adopted with the need to apply the quantitative method to explore or discover emerging phenomena, test variables or instruments (Creswell, 2006; Creswell & Creswell 2018). Embedded methodological design use one method to additive the other. It adopts different methods to answer the research questions. (Creswell, 2006).In the fourth type of the mixed method approach, the triangulation methodological design is based on the combination of methodologies to test theory or hypothesis. The triangulation methodological design has been used broadly in mixed methods research where it enables researchers to use both qualitative and quantitative approach to obtain integral data (Creswell & Creswell, 2018).

Researchers regard the mixed-method approach as a more effective method of conducting research than the adoption of a single approach (Lee, 1991; Moffatt et al., 2001; Maxwell, 2013; Creswell & Creswell, 2018). It involves analysing both qualitative and quantitative data to answer the research questions or hypotheses (Creswell & Creswell, 2018). Hence, data collection involves the collection of both numeric and textual information, leading to research data elicited via both quantitative and qualitative methods (Creswell, 2013). Mixed-method research, regarding to Newman

et al. (2003), serves many purposes including, but not restricted to, prediction; adding to the knowledge base; measuring evolution; understanding complicated phenomena; examining new approaches, and generating new ideas. Mixed-method research aims to develop a 'better understanding' of the object of study, and this 'better understanding' can be filtered into five precise benefits or goals: for the purposes of triangulation (for corroboration and validity); to enable deeper understanding of different facets of the same complex phenomena (complementarity); the use of subsequent methods (development); to obtain difference or conflict (initiation); and to ensure the scope and range of the study (expansion) (Greene, 2007). Creswell and Creswell (2018, p. 216) and Bryman (2012, p. 633) argued that the use of a hybrid mixture of both qualitative and quantitative methods involving the combination of theories and practice has several benefits. These benefits are:

1. Minimising the limitations of both quantitative and qualitative approaches.
2. Mixed methods provide a sophisticated and holistic approach to research.
3. Using both approaches enhances the integrity of research findings.
4. Enables the evaluation and validation of research data or outcomes.
5. Research benefits from using qualitative or quantitative research methods to clarify findings created by the other method.

Other terminologies which have been applied to mixed-method research include integrated approach, combined methods, hybrid approach (Blaikie, 2010) multimethod, mixed research, synthesis and mixed methodology (Creswell & Creswell 2018). There are three core mixed-method research designs: convergent, explanatory sequential and exploratory sequential designs. Other complex designs are mixed-method experimental, mixed-method case study, mixed-method participatory-social justice and mixed-method evaluation (Creswell & Creswell 2018). Figure 3-3 presents a summary of the three core design methods.

3.3.2 Research philosophies and paradigms

The philosophy of science relates to the theoretical background that underpins the search for knowledge (Ponterotto, 2005). On the other hand, research philosophy focuses on the nature of knowledge and how it is developed, and the different assumptions underlying researchers' views of the world. Researchers' assumptions affect their chosen research methods and strategies. A paradigm is a "set of interrelated assumptions about the social world which provides a philosophical and conceptual framework for the organized study of that world" (Filstead, 1979, p. 34). Creswell and Creswell (2018) referred to research paradigm as a worldview, which is a certain set of beliefs that inform action. Researchers' philosophical assumptions, participants, tools, instruments and approaches to investigation are guided by their selected research paradigms (Denzin & Lincoln, 2000) Research paradigms adopted in previous studies include positivism, realism, constructivism and pragmatism (Creswell & Creswell, 2018). This section presents a discussion of these research worldviews.

Positivism assumes the existence of a social reality that is controlled by universal truth. Positivist researchers base their philosophical assumptions on the premise that social phenomena and the meanings that are attached to them exist independent of social actors (Bryman, 2012). Positivism is also referred to as scientific research, postpositivist research, empirical research and postpositivism. Researchers taking a positivist stance approach research using theories and models that rely on observation and facts while adopting a quantitative research approach (Ayikoru, 2009). Positivists or postpositivists adopt a deterministic philosophy where outcomes are thought to be probably determined by effects or causes. Hence, the positivist research paradigm is more applicable to quantitative research than qualitative research (Creswell & Creswell, 2018).

Realism is a research paradigm that lies between the two extremes of positivism and constructivism or interpretivism (Creswell & Creswell, 2018).Realism was developed within the positivist research paradigm by its supporters. It is a philosophical stance that is also connected to scientific investigation. There are two branches of realism,

namely direct and critical realism. Direct realism is built on the view that human experiences through the senses reveal the exact meaning of the world (Alvesson & Sköldberg., 2000).Critical realists, on the other hand, maintained that human experiences are just sensations which symbolise images of the actual world and not the real things (Saunders, et al., n.d.). Hence, they argued that some observations could be weak, leading to unexpected results. “Critical realists stress the generalizing task of scientific activity. However, their stand is not to be confused with that of positivism, with its interest in predictable patterns. Instead, critical realism seeks to identify those deeper lying mechanisms which are taken to generate empirical phenomena” (Alvesson, 2009, p. 40).

Constructivism, which is often referred to as social constructivism or interpretivism, is typically viewed as an approach for conducting qualitative research (Creswell & Creswell, 2018). Mertens (1998) revealed that social constructivism is often used in conjunction with interpretivism. The constructivist research paradigm is seen as a substitute for the positivist position. Social constructivists take the view that individuals develop subjective meanings which can be varied and multi-dimensional. Hence, the researcher should seek to assign a complexity of views to objects or things instead of limiting these meanings to a few categories. Social constructivism evolved from the idea that subjective views are formed through cultural, historical norms and social interactions, and are not just etched in the individual’s mind (Creswell, 2007; Creswell & Creswell, 2018). Deep meaning in individuals can be revealed through the interaction between the researcher and the research applicants. A major characteristic of the constructivist position is the centrality of this interaction (Ponterotto, 2005). The goal of researchers advocating constructivism is to depend as much as possible on the way the research respondents view the situation under investigation. Hence, broad and general questions are used to elicit deep meaning in the research participants.

Pragmatism is a research paradigm that emanated from situations, actions and consequences instead of antecedent conditions of postpositivism (Creswell, 2007; Creswell and Creswell, 2018). Pragmatists are of the view that the research questions

inform to a large extent the research philosophy that is adopted by the researcher. Hence, the research focus is on the research problems and questions rather than the research methods (Denzin & Lincoln, 2000). Pragmatists argued that it is appropriate to adopt both qualitative and quantitative (mixed-method) approaches within a particular study (Saunders et al., 2009). They maintained that regarding the reality of nature, there is no such thing as absolute knowledge. It is to this end that Tashakkori and Teddlie (1998) took the view that pragmatism is an attractive research position as it avoids the dispute between the idea of truth and reality. Researchers adopting the pragmatist stance use multiple research approaches to achieve the best possible solutions to the research questions. They employ both qualitative and quantitative methods of data collection, with a focus on the research outcomes and consequences (Creswell, 2007). See Table 3-2 for information on the four research paradigms.

Postpositivism	**Constructivism**
• **Determination** • **Reductionism** • **Empirical observation and measurement** • **Theory verification**	• **Understanding** • **Multiple participant meanings** • **Social and historical construction** • **Theory generation**
Transformative	**Pragmatism**
• **Political** • **Power and justice oriented** • **Collaborative** • **Change oriented**	• **Consequences of action** • **Problem-centred** • **Pluralistic** • **Real-world practice oriented**

Table 3-7 four research paradigm worldviews. Source: Creswell and Creswell (2018)

3.3.3 Research paradigm advocated

The research aim and objectives of the current study seem to lend themselves well to the pragmatist worldview. To recall, pragmatists argued that it is appropriate to adopt both qualitative and quantitative (mixed-method) approaches within a particular study (Saunders et al., 2009). Pragmatism is not dedicated to a particular system of philosophy and realism. Hence, researchers draw freely from both qualitative and quantitative research assumptions during the research process (Creswell & Creswell, 2018). This may be why researchers taking a pragmatist worldview use mixed methods of data collection, focusing on achieving the best possible research outcomes that answer the research questions (Creswell, 2007). Researchers adopting this view operate on the belief that gathering multiple forms of data allows for a broader understanding of the research problem than is possible using either qualitative or quantitative data alone (Creswell & Creswell, 2018). The balance between the objective act of positivism and the subjective act of constructivism led the researcher to adopt pragmatism, as pragmatism is open to the use of numerous approaches, different hypotheses and different ways of data collection and analysis. Thus, adopting a pragmatist worldview is the best fit for this research, where the pragmatism paradigm accepts different and multiple views to answer the research questions. Thus, to investigate subjectivity (luxury) versus objectivity (sustainability), a flexible paradigm was needed that enabled the adoption of both qualitative and quantitative methods as this research needs to address these two different issues. A pragmatist view was imperative to qualitatively understand hotel guests, designers and hotel managers and their definition of luxury material finishes within the high-end hotel guest room. Additionally, it required an investigation that would implement measurements of the sustainability of material finishes. See figure 3-3 of the three core mixed methods design.

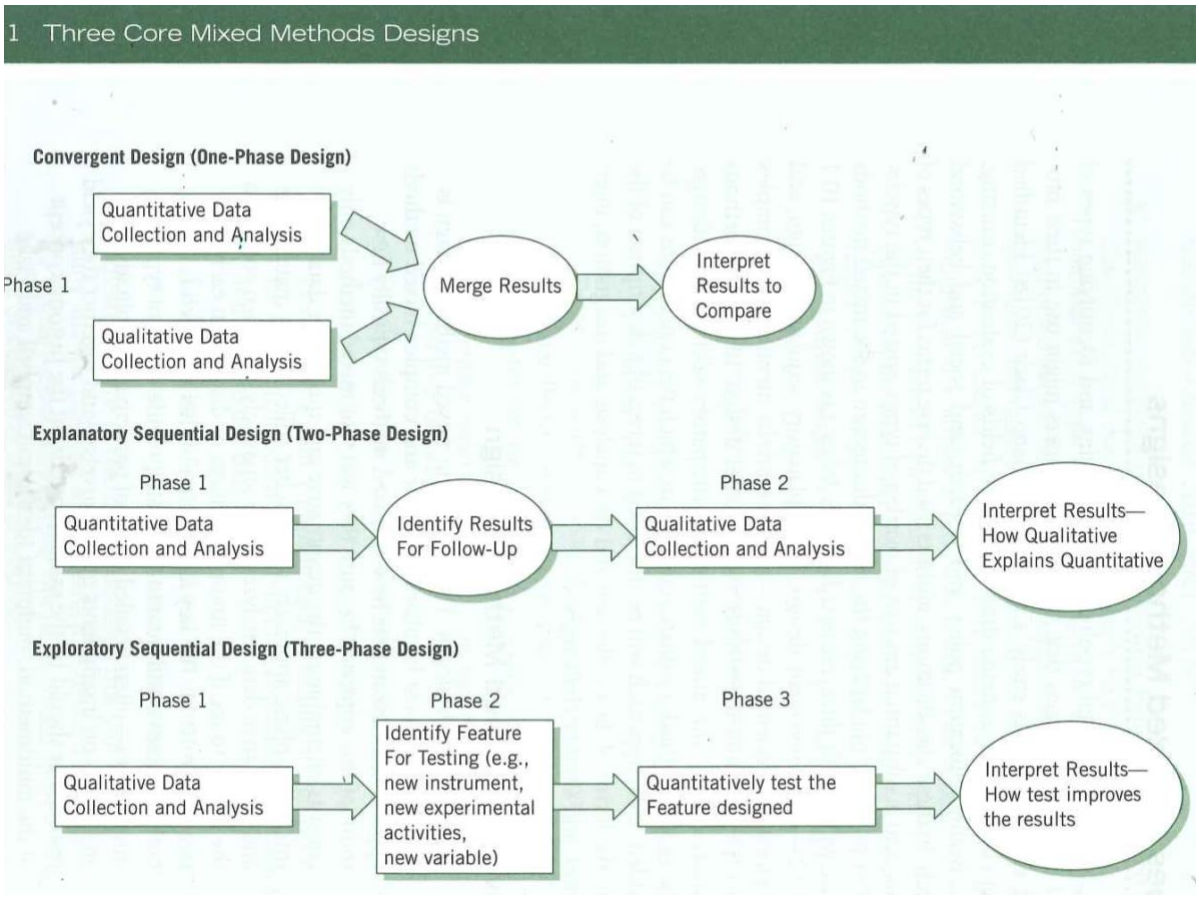


Figure 3-3 three core mixed-method designs. Source: Creswell and Creswell (2018)

3.3.4 Advocating the mixed-method approach

This section presents the methods used in this study and explains the reasons behind choosing these methods over others. Having obtained an overview of the research methods, and having considered the research questions, aims and objectives in the context of the research limitations mentioned in section 3.2, led the researcher to the choice of mixed methods for this study. This decision was based on the premise that to obtain a real understanding of the complexities of this research context, as well as to achieve the aim and objectives of the research, no single method would be the best configuration. A mixed-method approach was therefore adopted to generate the primary data, with support from secondary data.

Previous researchers have argued that the combination of research methods should be informed by the research aim and objectives (Robson, 2002; Creswell, 2003). The combination of different research approaches enables triangulation, which can lead to more reliable research outcomes (Bryman & Bell, 2015). In a research study that adopts both quantitative and qualitative methods, the qualitative approach could serve as a check against the possible limitations of the quantitative method. The qualitative method, on the other hand, is required to balance the subjective views relating to the researcher and the research participants (Creswell & Clark, 2007).

The current research employed a survey questionnaire, interviews and case study to elicit data. This data were used to aid the production of the proposed design guide for selecting luxury sustainable material finishes for high-end guest rooms, using carpets as a case study.

In this study, quantitative data were mainly collected using a survey questionnaire distributed to interior designers and architects to determine the requirements of the production of the proposed design guide. The second questionnaire instrument was designed for luxury hotel guests to investigate their interest in sustainable hotel interior finishes.

Qualitative data in this study were mainly collected using semi-structured interviews with designers, manufacturers, hotel managers, and BREEAM members. The aim was

to explore general ideas and opinions on relevant aspects of luxury material finishes, including definitions, interest in luxury sustainable hotels, reasons behind the slow interest in sustainability within the hotel industry, and whether designers are in need of design guide to help them select luxury sustainable material finishes for hotel projects. Semi-structured interviews with experts and professionals offered sufficient flexibility for obtaining in-depth answers and provided the respondents with the chance to share their practice and experiences in the field.

Additionally, qualitative data were collected through case studies on two luxury hotels in London. The hotels' use of flooring material finishes was investigated to determine the extent to which they have adopted sustainability in the selection of flooring materials and the reasons behind the slow adoption of sustainability measures, especially in hotel-building material selection.

3.3.5 Selected research methods

Case study research is a very common method that has been embraced by several architecture, management, business, and energy technology scholars, such as Ahn and Pearce (2013), Jones et al. (2013) and Bohdanowicz et al. (2001) and others, in researching sustainable hotels. Ahn and Pearce (2013) conducted a critical contextual analysis in order to understand how green hotel buildings can balance the twin aims of sustainability and luxury. By depending on printed and online sources or visiting existing projects, the case study method can be seen as an essential stage in understanding the contextual effect of a building, material or a product.

The other most common methods used in this area of research are survey questionnaires and interviews. Survey questionnaires are generally easy methods to gather representative data from a large population (Picardi & Masick, 2014). Han and Yoon (2015) adopted survey questionnaires to measure the environmental awareness of hotel customers, conducting their survey through online websites or via email. Yang and Mattila (2016) also adopted a survey questionnaire to examine their suggested luxury hospitality value framework, recruiting an online research company to recruit

respondents who dine at luxury restaurants. Máté (2006) adopted a survey questionnaire with 20 senior designers from design firms specialising in sustainable design, to examine how designers research and choose eco-materials. Moreover, Máté (2006) used a materials sample board in his survey to investigate how designers can source materials; this method inspired the researcher in this study to adopt a survey questionnaire with designers, as well as using a sample board to test carpet materials to examine luxury carpet specifications.

The other methods found in the literature and also adopted by the researcher include interviews. Ahn and Pearce (2013) adopted the case study method to answer their research questions, but at the same time, where their research relied on the group of large amounts of data from different sources, they gathered information by interviewing both the hotel operators and the architects who practise green design. Dubois et al. (2005) conducted in-depth interviews studying consumer experiences of luxury by interviewing 16 people.

In summary, these are the most common methods in the literature, as seen in Table 3-3. The selection of these different methods was not based solely on them having been used in previous studies, but also on the fact that they inspired the researcher to adopt methods that can be used to tackle and answer the research questions and aims, and to consider the research problem. Moreover, the research limitations dramatically controlled/influenced the selection of methods as well as the sample size. With regard to the complexity of this research in the face of subjectivity around luxury and objectivity around sustainability, this added to the need to use different methods to address this research gap.

These different factors resulted in the need to obtain both qualitative and quantitative data to answer the research questions.

Scholar	Methods

	Interviews	Survey questionnaire	Case study
Mate (2009)	✓	✓	
Hayles (2015)	✓	✓	
Lee (2014)			✓
Kang and Guerin (2009)		✓	
Ahn and Pearce (2013)	✓		✓
Bohdanowicz et al.			✓
Hillier and Comfort (2013)			✓
Picardi and Masick (2014)		✓	
Han and Yoon (2015)		✓	
Yang and Mattila (2016)		✓	
Dubois et al. (2005)	✓		
Adopted methods	✓	✓	✓

Table 3-8 key scholars' adopted research methods. Source: author.

3.3.6 Rejected research methods

The current research has excluded and rejected a few methods adopted by researchers in the fields of sustainability within hotel buildings. This was due to limited time and funds, and also some methods will be considered for use in future work.

The Delphi method study used by Chen et al. (2015) required the adoption of the Delphi method from the beginning to the end of the research. This involved choosing

nine hotel management professionals to study the suitable indicators of hotel green interior design by applying the evaluation process in two stages (rounds). Unfortunately, adopting the Delphi method was a difficult task to achieve as hotel operators and designers could be too busy to accept a second or third interview or even a survey questionnaire, which would make it difficult for the researcher to collect data. Additionally, it would consume a large amount of time waiting for participants to respond initially before conducting a second or third interview or survey.

Dutfield et al. (2011) at the Building Research Establishment (BRE) conducted a study to measure the environmental impact of floor finishes by adopting life cycle assessment (LCA) to measure the environmental impact of different floor finishes. This method (LCA) was rejected by the researcher as a large amount of time is needed to run a life cycle assessment, as well as the fact that it requires a large amount of data about each flooring material which can only be accessed from the manufacturer. Moreover, running a life cycle analysis needs specific software which is not available to the researcher, as well as requiring flooring materials treated in different circumstances and at different temperatures to examine their durability; unfortunately, this was too challenging a method to adopt. As an alternative, the researcher decided to rely on the existing LCA of flooring materials produced by BRE.

Ning et al. (2016) adopted the focus group method to produce indicators and investigate the socio-technical systems feature of green interior design domestic buildings in China by selecting seven participants for the focus group rounds. This method was almost impossible to adopt in the current research, where the busy lives of the professionals (designers, manufacturers, hotel managers, BREEAM) made it difficult to adopt such a method and be able to bring designers all together in one place at the same time; the same problem would apply for the other professional participants in this study.

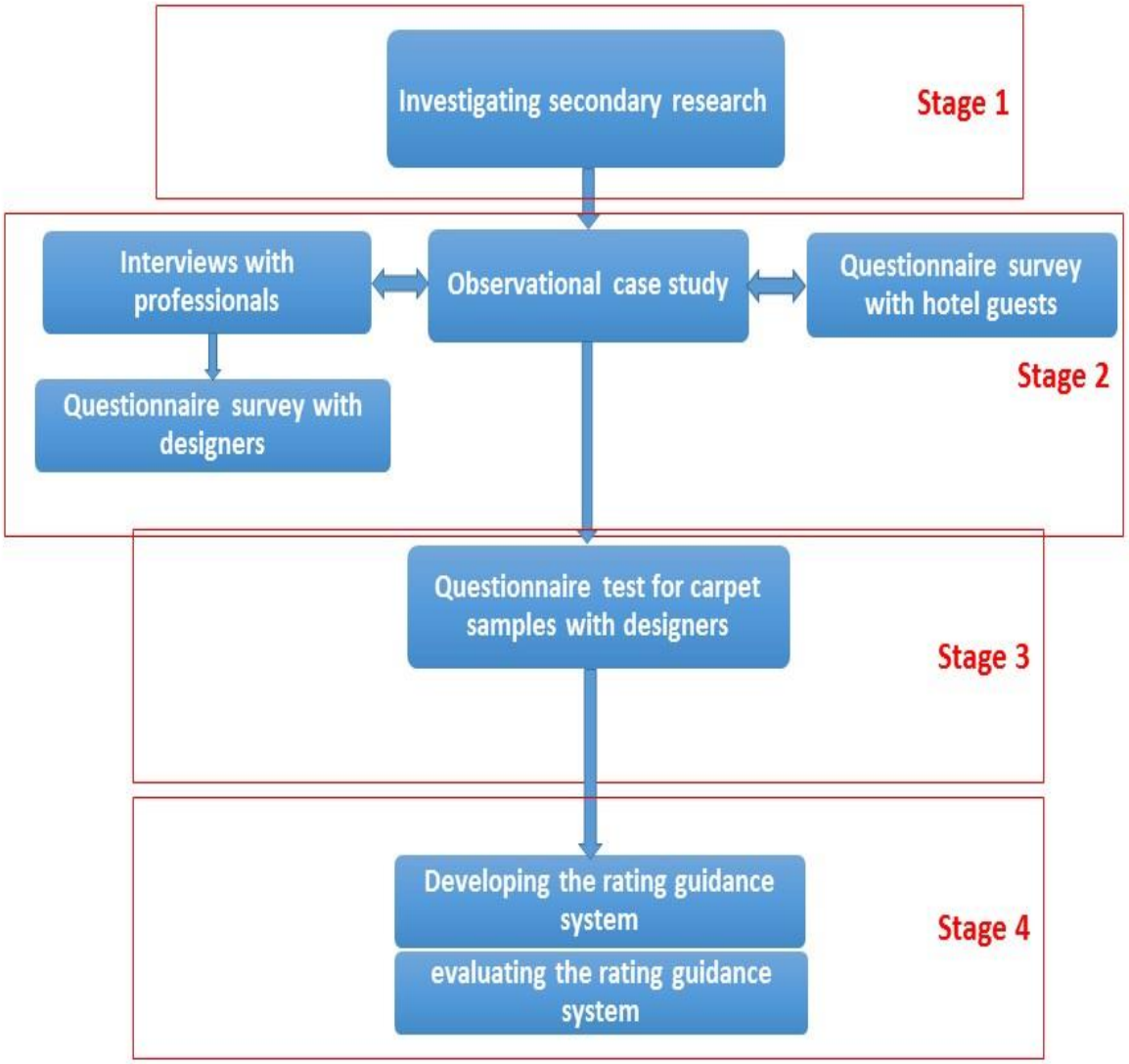
3.3.7 Research methodological framework.

The theoretical research framework in this study operates as a guide that provides borders and offers explanations for the series of methodological phases and the

relationship with the research methods used. A research methodological framework is the main structure on which a research study is based (Bell, 2005). Furthermore, according to Lithner (2008), a research framework is “a theoretical framework [that] guides research activities by reference to formal theory” (Lithner, 2008, p. 256). In accordance with the research aim, this research incorporates multidisciplinary areas and has required the construction of a multi-stage research methodology to accomplish the main aim of this study. Consequently, the researcher created a graphical illustration of the planned research methodology implemented in this study. Figure 3-4 provides a general overview of the methodological framework. The graphic presents a concatenated methodology that has been established to carry out this research in a structured and logical way through the different phases.

The multi-stage research methodology graphic for this research, as mentioned above, was developed to describe the stages of the overall methodological framework of this study. The stages have been constructed in a detailed way, based on the research needs

Figure 3-4 research methodology stages. Source: author



As well as on the difficulties the researcher faced, but yet are logical and are easy to understand for the reader, as seen in Figure 3-4.

Stage 1 involved investigating the secondary research data, focusing on investigating luxury and sustainability within the hotel industry, material finishes and the environmental profile certification scheme through which BRE assesses and certifies the environmental performance of materials. Stage 2, where the researcher started to collect the primary data, was an observational case study with the aim of examining the luxury hotel guest room materials as luxury materials and as sustainable materials. This was conducted in conjunction with interviews with professionals based in London;

these interviews were carried out with designers to examine their perceptions of luxury sustainable hotels and to ascertain if they are interested in or are embracing sustainable materials in their hospitality projects, and to obtain their definitions of luxury material finishes. At the same time, interviews were conducted with hoteliers (hotel managers) to find out if they are interested in sustainability and to ascertain their perceptions of luxury material finishes. In addition, manufacturers were interviewed to examine the extent to which they are interested in making their materials sustainable and how they define luxury material finishes. BREEAM members were interviewed to find out more about their environmental assessment method and whether they had certified a luxury hotel before; at the same time, a questionnaire with luxury hotel guests was administered to examine their interest in staying in a luxury sustainable hotel, and to find out their perceptions of luxury material finishes in a luxury hotel. A questionnaire with designers was also administered. This was followed by Stage 3, which consisted of a test questionnaire on carpet samples with academics from an art and design background to examine the luxury carpet specifications. Finally, Stage 4 consisted of the development of a design guide to help designers, hoteliers and manufacturers select luxury sustainable finishes (using carpet as a case study) for luxury hotels in the UK, together with an evaluation of this design guide.

3.3.8 Research design

The aim of a research study is to seek knowledge about a topic or to pursue answers to a question (Picardi & Masick, 2014). Research designs, as explained by Creswell and Creswell (2018), are types of investigation within quantitative, qualitative and mixed-methods approaches that provide clear guidance for the methods to adopt in a research study.

Yin (1994, p.19) described research design that "guide's investigator in the process of collecting, analysing and interpreting observation. It is a large model of proof that allows the research to draw inferences concerning causal relations among the variables under investigation". What can be implied from this definition is that research design is the overall strategy and structure that contributes outcomes and explanation to the procedure and notion behind carrying such research (Nachmias & Nachmias, 1996).

Figure 3-5 illustrates the research design followed in this study to answer the research questions and accomplish the aim and objectives of this study the secondary data (literature review) revealed the gap in the study by examining the luxury and sustainability of high-end hotel guest room material finishes, focusing on carpets, as well as the study context. Based on that, a review of research methodology led the researcher to adopt a mixed-methods approach. Quantitative data from online questionnaires with designers and luxury hotel guests, and the carpet test questionnaire with academics, and qualitative data from the case study and interviews with professionals are required in order to satisfy the research questions, aim and objectives. The outcomes from the analysis of data fed into the development of the proposed design guide, which was later tested by professionals.

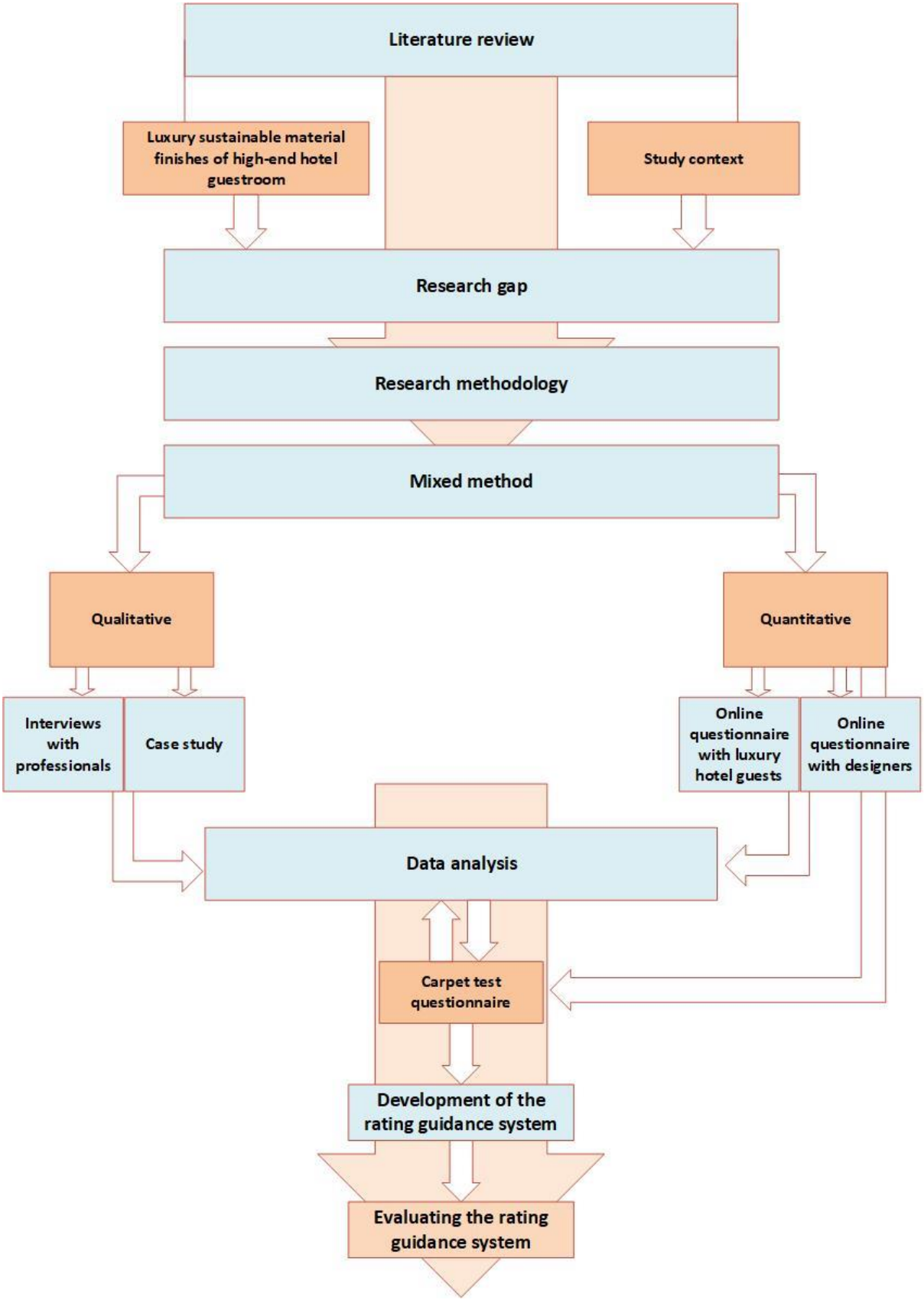


Figure 3-5 research design. Source: author

3.4 Data collection

This section focuses on the process of data collection and analysis from the data elicited from the secondary research, interviews, questionnaire survey, case study and the test questionnaire. The questionnaire survey was conducted with hotel guests and designers, while the interviews were conducted with designers, manufacturers, hotel managers and BREEAM. The site for the case study was selected within the research context area, that being the Dorchester London Hotel.

After deciding on the research methods, and based on De Montfort University rules, the researcher was granted approval from the ethics committee in the Art, Design and Humanities department to conduct the research methods. This followed the completion of an ethics form, assuring that the respondents' participation would be voluntary, willing and anonymous, and that all the data provided by them would be used for academic purposes only. Therefore, all data in this research were ethically obtained.

3.4.1 Secondary data

Secondary data (literature review) helps to identify the research problem and provides an understanding of the research gap (Creswell & Creswell, 2018). Gall et al. (2006) stated that there are different purposes for eliciting secondary data:

- To pay attention to a potential research which has been neglected in existing research.
- To gain insights into the research methodologies, techniques and strategies that may be applicable to answer our own research questions.
- To determine or develop research questions and objectives.
- To identify recommendations for further research in the existing literature to avoid repetition in our own work.

For a mixed-method research approach, Creswell and Creswell (2018) suggest reviewing the literature by dividing it into sections linked to key independent variables, considering five components: (1) Introduction; (2) Topic 1; (3) Topic 2; (4) Studies that address both Topics 1 and 2; (5) A summary.

In this research, the review of the existing work related to the research topic helped to answer some of the research questions. The secondary data was collected from different sources such as journal articles, reports, books, published official statistics and surveys such as “MINTEL” and online reports, or from relevant websites such as the “BREEAM” organisation website.

This study consists of multiple topics focusing on luxury and sustainability within the material finishes of high-end hotel guest rooms. The researcher identified various different resources in order to investigate the topics of luxury and sustainability. Only a few resources were found about luxury material finishes in terms of hotel interior design. Therefore, the researcher reviewed studies about luxury hotels from scholarly articles on different contexts that covered or tried to define luxury, such as within the domains of management, business, marketing and fashion. The secondary data helped to shape the research questions and define the research problem, as well as limiting the scope of the research to focus on carpet flooring material.

The secondary data was elicited and developed over the whole three years of the research study to keep it up to date.

3.4.2 Questionnaire survey design (hotel guests and designers)

A questionnaire survey is a common method of data collection. Survey designs, including questionnaires, can be administered through a variety of approaches: in hard-copy form or in electronic form through email and web links. The advantages of this research design method is the low cost in a study with limited financial resources. Moreover, it saves time and gives the researcher the capability to contact and reach

out to a large number of individuals over a short period of time (Picardi & Masick, 2014).

As noted by Cohen et al. (2017), the internet-based survey questionnaire is becoming more familiar and is increasingly being used by researchers. In this study, the survey questionnaire included both open- and closed-ended questions. Open-ended questions enable participants to answer freely and give answers in any detail or length. This enables researchers to obtain a greater level of detail in their answers than may be possible using closed-end questions. Close-ended questions provide respondents with a limited number of responses to choose from. These kinds of questions are simple and easier for data collection and analysis, and the researcher usually uses such questions to target a specific response set or if they have limited time or resources (Picardi & Masick, 2014).

The researcher administered the survey questionnaire using the online web-based service Google Forms. This website helped the researcher to design the survey questionnaire by using different tools and colour themes, and it was also possible to separate the survey questionnaire into sections. Moreover, there was no need to design different versions for smart phones, computers and iPads, as Google Forms generates these automatically. However, there are some disadvantages with this method, which should be taken into consideration. Targeted samples without access to the internet or computers cannot participate; moreover, making changes or developing the questionnaire might be time-consuming and need special technical skills (Picardi & Masick, 2014). Table 3-4 presents the advantages and disadvantages of different types of survey questionnaires.

	Hard-copy mail	Email and web links	Telephone	Face-to-face
Advantages	- Ability to reach a large number of individuals. - Researcher can obtain a random sample by using postal codes. - Respondents without computers or telephones can be reached.	- Ability to reach a large number of individuals. - Low-cost instrument.	- Selecting respondents randomly through area codes. - Real-time data collection.	- Real-time data collection. - Researcher can be there to provide clarification to any of the questions.
Disadvantages	- Can be time-consuming. - Response rate can be low.	- Respondents without a computer or internet access cannot participate. - Changing or developing the questionnaire can require special technical skills.	- Language barrier. - Respondents must answer the phone. - This may be intrusive or inconvenient. - Complicated questions with different response options might be difficult without visual information.	- Time-consuming. - Respondents may feel under pressure to answer certain questions.

Table 3-9 advantages and disadvantages of different types of survey questionnaires. Source: Creswell and Creswell (2018)

- Designers questionnaire survey

The designers' survey questionnaire was initiated as an additional method to generate more data due to their low response rate to agree to take part in interviews. This was necessary to seek their knowledge on the design of luxury five-star hotels with regard to hoteliers' requirements. Moreover, the survey questionnaire aimed at gathering their views on the interest of hotel users in the sustainability of luxury material finishes

for the guest rooms. Other areas covered in the questionnaire instrument included the definition of sustainability, relevance of guidelines for sustainable material specification in the design of five-star hotels, and the designers' interest in sustainability and sustainable materials.

The designers' survey questionnaire consisted of 14 questions; the first four questions collected background information on the respondents, while the other 10 questions inquired about the designers' background in sustainable material finishes, their knowledge in designing hotels, as well as their definition of hotel guest room luxury material finishes. A copy of the questionnaire instrument can be found in Appendix (A).

- Hotel guests questionnaire survey

3.4.2.1 Pilot survey

Pilot surveys are of great importance in ensuring that the questionnaire instrument functions well, as well as for regulating which questions drive respondents to answer in the same way, as this might result in insignificant results being obtained (Bryman, 2012).

The researcher conducted a pilot study survey and interviews with five respondents to validate the questions and to correct wrong or misunderstood ones. It was found that some questions needed modification where the respondents could not understand the question, and some of the response options needed some additions so that respondents could have more options to choose from.

The second survey questionnaire targeted luxury hotel guests, and was initiated after the refusal of hotel managers to allow the researcher access to interview or email guests, or even to leave a hard copy in the guest rooms or in reception. The questionnaire consisted of 11 questions, consisting of two background questions (on gender and age) and nine questions inquiring about the guests' interest in staying in a luxury sustainable hotel, their views on some sustainable hotel practices, their

definition of luxury guest room finishes, and what luxury flooring materials they would prefer to see in their hotel room. A copy of the questionnaire instrument can be found in Appendix (B).

3.4.2.2 Sampling for the designers and luxury hotel guests questionnaire survey

To ensure the survey questionnaire's validity and reliability, it is crucial to determine and construct the correct sample of related cases from a population that embraces the essential characteristics of the study (Picardi & Masick, 2014).

There are different sampling methods available. For instance, in a multi-stage sampling procedure, the researcher has access to groups or organisations, and finds the names of individuals within these groups and then constructs a sample from this information (Creswell & Creswell, 2018). This sampling procedure was the best method to use for the designers' survey questionnaire. As mentioned in Chapter 1, the research context area is London, and sending the survey questionnaire to all the designers in London would be a difficult task as there are countless design firms. Therefore, a decision was taken to follow the approach of Kang and Guerin (2009), who investigated how interior designers use environmentally sustainable interior design materials by selecting interior designer practitioners from the American Society of Interior Designers (ASID) website and emailing them randomly. The researcher accessed the website of the Royal Institute of British Architects (RIBA), which includes all the registered architect firms in the UK. The researcher filtered the results to limit the location as well as filtering the results according to the service provided and the commercial experience, where the researcher chose the sustainable design service and the hotel commercial experience. The results consisted of 171 design firms located in London. However, due to the lack of respondents from the multi-stage sampling method, the researcher used random sampling to obtain more respondents, attending a sleep exhibition and eco-build exhibition in London, and reaching out to designers there.

On the other hand, the sampling for the hotel guest survey questionnaire was conducted using both single-stage and multi-stage sampling procedures. The reason behind using both procedures relates to the difficulties encountered in collecting data

from hotel guests, where the hotel managers refused to share their guests' emails or even share the questionnaire with them. Therefore, the researcher used the single-stage sampling procedure to gain access to names, and then could access people directly for sampling purposes (Creswell & Creswell, 2018). The researcher constructed a single-stage sample of luxury hotel guests consisting of friends and relatives with access to luxury hotels, and they were contacted through email. Additionally, the multi-stage sampling method was adopted using the social media application Instagram. The researcher searched for famous Instagram accounts on luxury travel or luxury hotels that have millions of followers, contacting the account owners by the email address provided in their account details; if an email address was not provided, the researcher instead used the message tool in Instagram to contact them and send them the link to the questionnaire.

3.4.2.3 Main questionnaire survey delivery

A link to the designers' survey questionnaire was sent to the email addresses collected from the filtered 171 results from the RIBA website. The researcher received eleven automatic error emails, and five emails from respondents confirming completion of the survey questionnaire. After waiting for two months, the number of respondents only totalled seven. Therefore, the researcher implemented the random sampling method by attending the sleep exhibition and eco-build exhibition, as mentioned in the section 3.4.2.2, and reaching out to the designers there by asking them to complete the survey questionnaire using the researcher's iPad to make it easier for them.

The hotel guests' survey questionnaire was distributed through the social media app, Instagram, by searching for luxury hotel bloggers and famous accounts related to travelling and luxury such as the *Beautiful Destinations* and *Luxury Traveller* accounts, etc. A link to the questionnaire was sent via Instagram or to the email address included on their Instagram account profile.

3.4.2.4 Analysis of questionnaire survey

Online-based services like Google Forms provide automatically collated results and present the results in a descriptive manner through the use of graphs. However, the researcher needed to use Excel software alongside the results provided by Google Forms. The details of the survey questionnaire analysis is presented in detail in Chapter 4.

3.4.3 Interview design (designers, manufacturers, hotel managers, BREEAM members)

Interviews are used to gather information in applied settings, and can be conducted face to face (one to one or in a group) depending on the situation and need (Picardi & Masick, 2014). They are a means of generating data by seeking responses from research participants on issues pertaining to their daily activities (Miller & Brewer, 2003). There are three main kinds of interviews for collecting data: structured interviews, semi-structured interviews, and unstructured interviews (Saunders et al., 2009). In this study, interviews were conducted using different methods: face-to-face, telephone, and email interviews. Telephone and in-person interviews were conducted using an interview schedule where the researcher read out the question to the respondents and recorded the answers (Graziano & Raulin, 2007).

The researcher used semi-structured interviews to elicit views and ideas from the participants (Creswell & Creswell, 2018); these interviews were carried out with designers, hotel managers, manufacturers and BREEAM members.

- Designers' interviews

  The interviews with designers involved interior designers and architects in private practice from large design firms specialising in hospitality design or sustainable design, or both. The researcher filtered these hospitality design firms through the RIBA website and contacted them through email to arrange an interview. Interviews were conducted to provide information that can address some of the research questions. The designers' interview instrument consisted of 10 questions,

with interviews lasting between 20 and 40 minutes, and taking place in London. The researcher inquired about their interest in designing and including sustainable materials in their projects, whether they find it hard to select luxury sustainable materials for hospitality projects, their preferred carpet material to select for a high-end hotel guest room, and whether designing a guidance rating system would help them in creating a luxury sustainable interior environment. See appendix (C) for the designers' interviews instrument.

- Hotel managers' interviews

Interviews with hotel managers were essential to close the circle and to provide missing information about hotels' slow take-up of sustainability, to further understand the incompatibility between the subjectivity of luxury and the objectivity of sustainability, where this was the main reason to adopt the pragmatist paradigm to collect more data related to both subjectivity (luxury) and objectivity (sustainability) where this paradigm is flexible to cover both qualitative and quantitative data. The hotel managers' interview instruments consisted of 13 questions focused on their interest in sustainability, how they embrace luxury as high-end hotels, and how they define it within the hotel industry, as well as the clients' interest in luxury and sustainability from the hotel managers' perspective using semi-structured interviews. Interviews with hotel managers took place in London, in their hotels.

- Manufacturers' interviews

Interviews with manufacturers took place in London and Leicester, where some of the interviewees were very cooperative and came to Leicester to do the interview. The interviews consisted of 10 questions asking about the sustainable materials they use (if they use such materials), or their interest in sustainability, and whether their sustainable materials are certified. Also, they were asked for their perspectives regarding their definition of luxury material finishes.

- BREEAM members interviews

Interviews with BREEAM members were conducted to investigate their green guide of specifications and the environmental profiles for materials. Additionally, the interviews examined the reasons behind the lack of existence of a certified hotel from BREEAM. BREEAM interviews were conducted over the telephone, where both of the BREEAM members were very busy to accept a face-to-face interview. The BREEAM members' interview instruments consisted of 5 questions.

3.4.3.1 Pilot interview

The pilot interview was conducted with two professionals over email: one from BREEAM and the other was a designer. After answering the questions, both participants recommended modifying some of the questions as one of the questions was misunderstood.

3.4.3.2 Sampling for the main interview

It would not be practical to interview all the designers, hotel managers, manufacturers, and BREEAM members. Hence, the researcher adopted the most appropriate sampling method to select representative samples from all the categories of possible respondents to represent the general population. The selection of the different categories of respondent was based on their experience in selecting material finishes for hotel projects. Additionally, the research limitations played a major role in restricting the number of interviews.

- Sampling of designers

  The researcher faced some difficulties in contacting interior designers and architects in London. At the beginning, and as mentioned in section 3.8.1.2, the researcher used a multi-stage sampling method by using the RIBA website to contact interior designers and architects specialising in sustainability design and hospitality design, but the responses were very low even when contacting them over the telephone; some responses were refusals because of their busy schedules.

The researcher then tried to build connections through the academic staff at the Art and Design faculty at De Montfort University, and by attending exhibitions like eco-build and the sleep exhibition in London. From there, the researcher was able to arrange four interviews with interior designers and architects and also conducted the survey questionnaire.

- Sampling of manufacturers

Manufacturer sampling was conducted using multi-stage and single-stage sampling. The researcher knew two of the manufacturers through her connections, and gained access to the other two by searching for sustainable material manufacturers in the UK and reaching out to them.

- Sampling of hotel managers

The researcher initially used multi-stage sampling by limiting the hotels in London to only five-star luxury hotels, and contacting the hotels by email and telephone to gain their approval for interviews; however, the positive responses amounted to zero. Therefore, the researcher conducted random sampling by visiting London for a few days and visiting these luxury hotels and asking to meet their managers. In addition, she attended the sleep exhibition and scheduled a meeting for an interview with a hotel manager.

- Sampling of BREEAM members

The researcher used single-stage sampling with BREEAM and directly contacted them, and they then directed the researcher to the right two persons to interview in relation to the research topic.

3.4.3.3 Analysis of interviews

Content analysis is an objective and structured means of classifying and describing phenomena (Sandelowski, 1995). Stemlar (2001) described content analysis as a process of summarising long textual data into fewer content groups through the process of coding. The researcher used content analysis to examine relevant data sources for the study questions, using a systematic technique for categorising and coding the qualitative data. This can be conducted manually or through the use of software applications (Picardi & Masick, 2014). Content analysis can be used for the analysis of both quantitative and qualitative data using either an inductive or deductive approach (Kyngas & Lauri, 2005). Inductive and deductive methods of content analysis involve three stages of preparation, organisation and reporting. Content analysis was used to analyse the research interviews.

In this research, content analysis was conducted for the four interview categories (designers, hotel managers, manufacturers, BREEAM), by relating the data to their questions and coding based on the research questions using a software program called NVIVO.

3.4.4 Case study

A case study is a common method which is widely used but not completely understood, and can be defined as “an intensive study about person, a group of people or a unit, which is aimed to generalize over several units” (Gustafsson, 2017, p. 2). Gustafsson (2017) noted that there are two different kinds of case study, a single case study and a multiple case study, explaining that the difference between them is that multiple case study research consists of using multiple cases to understand the differences and resemblances between the cases.

The current study relied on one case study to investigate and understand the material finishes used in the guest rooms of two luxury hotels, focusing on the carpet as a flooring material finish. The aim was to ascertain the specifications of these luxury

materials to help in defining the luxury material finishes; these specifications also helped the researcher to comprehend their impact on the environment and the users. In Chapter 2, section 2.5, a background review was provided about London (the case study location), including information about its climate, economy, tourism and sustainability within the hospitality context. Information was also provided about the advantage of selecting London as the research location, focusing on its importance as a tourist city in the UK. This case study was analysed using visual inspection of the photos taken from the case study website and based on the information gathered from the hotel manager about the carpet specifications used in the hotel.

3.4.4.1 Sampling for the case study

The reason behind selecting one case study relates to the research limitations, where the researcher faced difficulties in accessing luxury hotels in London due to the refusal of hotel managers to participate in the research. Additionally, due to lake of information regards the carpet specifications used in their hotels where they consider it as secret information that these carpets made specifically for their hotel chain and only one hotel provided the researcher with information about their hotel carpet specifications. The sampling of hotels that the researcher conducted at the beginning of the study failed to achieve the targeted number (two hotels) depending on Ahn and Pearce (2013) by following a criteria they used in their study to select the case studies only with on different where he used LEED rating system and the researcher here used BREEAM rating system as one of the criteria's to select a case study; BREEAM A+ accreditation, luxury classification by the AAA stars rating system or any luxury classification in the UK, and location (London). Based on these three standards the study only recognised hotels which are located in London and classified as luxury hotels but none of London hotels are certified with BREEAM A+.

Therefore, after setting the case study criteria and restrict the targeted case studies within the area of London and rated as a five-star hotel, the researcher contacted these hotels by emails and telephones but got no response. Subsequently, the researcher planed a trip to London to visit the luxury hotels and meet with their

managers. The outcome of this trip produced three interviews with hotel managers and one case study.

3.4.5 Carpet test questionnaire

The carpet sample board test survey was conducted after collecting data using the previous methods and analysing the data. The test questionnaire was inspired by Mate (2009), who used a sample board to see how designers select sustainable materials. The researcher used the test questionnaire to investigate the appropriate luxury carpet specifications, and whether these luxury specifications meet the requirements of sustainable ones. The researcher would then be able to specify a guidance rating system to help designers and hotel managers to select luxury sustainable materials for luxury hotel guest rooms. This test questionnaire required the researcher to design a catalogue of a mix of luxury carpets and certified sustainable carpets from BRE. The respondent could then look at, touch and feel the samples and answer the accompanying questionnaire comprised of eight questions, all of which asked about the carpet samples; this would help to develop the guidance rating system.

3.4.5.1 Sampling for the carpet test questionnaire

- The carpet samples used in the test questionnaire were chosen based on two criteria: having the BRE environmental profile and named as luxury carpets by manufacturers. The researcher selected 17 carpet samples; 10 carpets have BRE environmental profiles. These were selected by choosing manufacturers

listed on the Green Book Live website which is generated by BRE; these manufacturers had been awarded environmental profiles that show their environmental impact. The researcher contacted these manufacturers through their websites and ordered some of these carpets awarded with environmental profiles from BRE. The other seven carpets were also selected via multi-stage sampling, where the researcher searched for carpet manufacturers based in London that provide luxury carpets to residential or hospitality projects and contacted them to order samples. After that, the researcher designed a catalogue combining both luxury carpets and those awarded with environmental profiles. She was able to mix all the 17 carpet samples, which made it easier for the participants to hold and touch these samples and answer the attached questionnaire. See Figure 3-6 showing the carpet samples catalogue.

- The test questionnaire sample was constructed using single-stage sampling, selecting respondents from the academic team in the Art and Design faculty at De Montfort University. This was because the researcher had very limited time and funds to carry out this test with designers in London due to their lack of cooperation: most of them did not respond to the emails requesting interviews

Figure 3-6 carpet samples catalogue. Source: author

and those who did respond did not have time to participate. Therefore, it was impossible for designers in London to be respondents of the carpet test questionnaire.

3.5 Chapter summary

This chapter has provided an overview of the research philosophy and a detailed description of the research methods implemented in this study. Having considered the research philosophy and research paradigms, the researcher decided to adopt a pragmatist worldview in the research process. A review of quantitative, qualitative and mixed-method research approaches informed the choice of mixed methods, which the researcher considered to be the most appropriate for this study. Interviews and the survey questionnaire were followed by a case study, and then a test carpet questionnaire followed which evaluated the design guide (see Figure 3-7). Survey questionnaires, interviews and a case study helped to develop the design guide for luxury sustainable carpets in high-end hotel guest rooms.

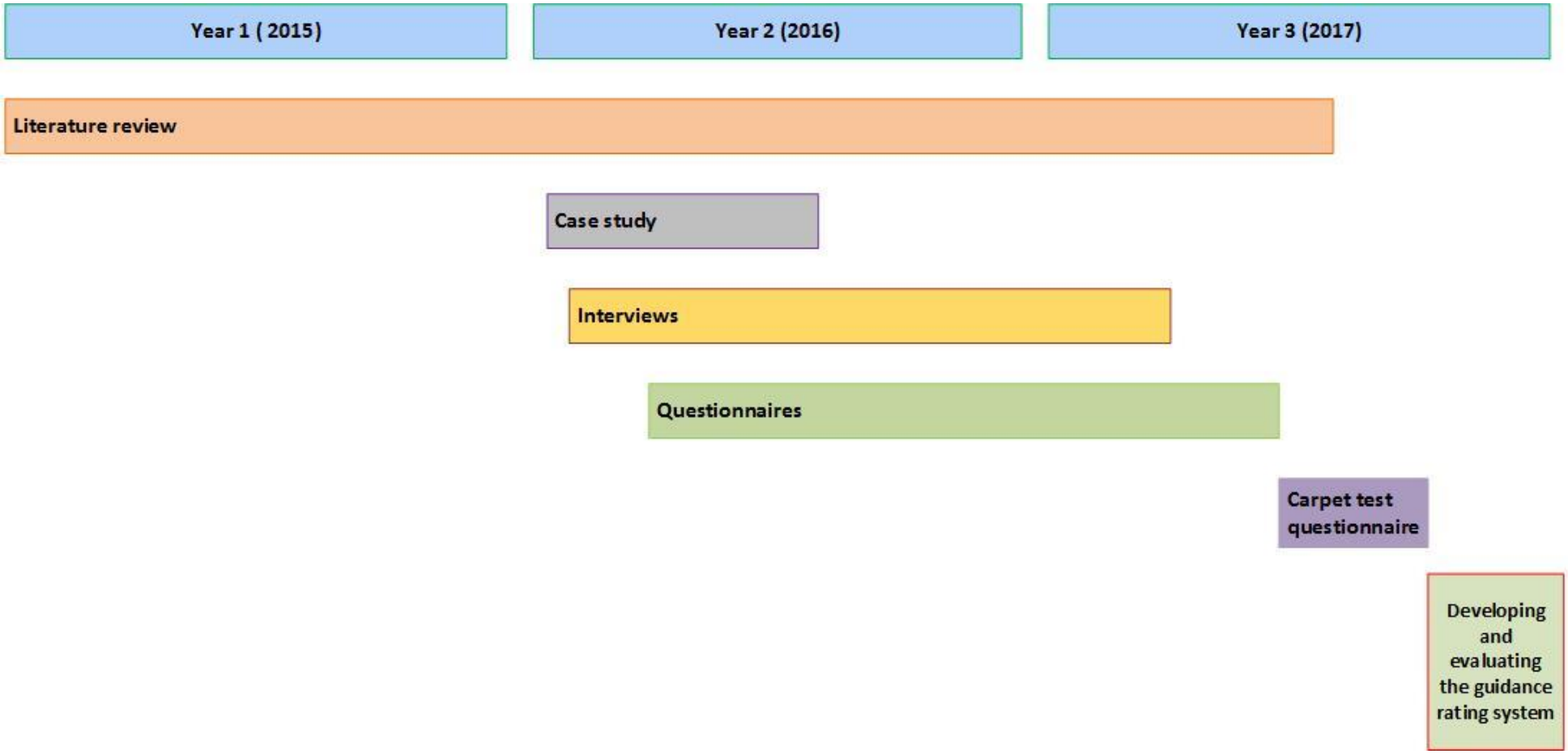
This chapter discussed the data collection methods for the selected research approaches. A brief discussion on sampling and sampling methods was presented, highlighting the sampling method selected for both the questionnaire and interview administration. Moreover, this chapter presented the selection criteria for the chosen case studies.

Justification for choosing to conduct the case study in London was presented, together with information on the criteria followed to select this case study location. Reasons behind choosing both the hotel guests' survey questionnaire and the designers' survey

questionnaire were provided. Finally, justification for choosing academics to participate in the carpet test questionnaire was also provided.

Chapter 4 will present the findings and analysis from these proposed methods. The findings from the analysis of these data are intended to guide the development of the proposed design guide.

Figure 3-7 research timeline of conduction research methods. Source: author


Year 1 (2015)
Year 2 (2016)
Year 3 (2017)
Literature review
Case study
Interviews
Questionnaires
Carpet test questionnaire
Developing and evaluating the guidance rating system

CHAPTER 4

Chapter 4: Research Data: Primary Research Activity, Findings and Analysis

4.1 Introduction to data results

This chapter presents the analysis and findings obtained through implementation of the research methodology (see Chapter 3). In particular, findings obtained from (1) interviews with designers, hotel managers, manufacturers and BREEAM members; (2) the case study; (3) the survey questionnaire administered to designers and hotel guests; and (4) the test questionnaire (see Figure 4-1) will be presented. Using the research questions presented in Chapter 1 as a guide, this chapter presents data that contribute to the understanding of luxury material finishes, the luxury hotel sector and sustainability, and the need for a design guide to help designers select luxury sustainable material finishings.

As outlined in Chapter 3, pilot questionnaires and pilot interviews were directed as an exploratory method of data generation, which helped to enlighten and refine the questions asked in the primary interview and questionnaire phases. In this chapter, data from interviews with designers, hotel managers, manufacturers and BREEAM members will be referred to using the abbreviations DS, HM, MF and BM, as shown in Table 4-1. In line with the adopted research ethics policy (see Chapter 3, section 3.4), participants' names will be anonymised through the use of codes when quoting the interviewees.

The hotel managers interviewed had between 15 and 35 years' expertise managing in the high-end luxury hotels in London. Three interviewees were male, and one was female. The designers interviewed had between 10 and 25 years' experience working on hospitality projects; two interviewees were male and two were female. The manufacturers interviewed had between 5 and 30 years' experience; two interviewees were male and the other two were female. With BREEAM, two interviewees were male

with more than 10 years' experience in BREEAM. The interview sample is small, which reflects the issues faced by the researcher as a consequence of selecting London as the research location. In London the large hospitality design firms were busy with their big projects and only a limited number of hospitality professionals agreed to be interviewed. For further information on this issue and others facing the researcher, see Chapter 3, section 3.4. Content analysis was adopted to analyse the interviews, as noted in Chapter 3, section 3.8.2.3.

This chapter covers the findings obtained through the other two methods: the case study and the two questionnaires.

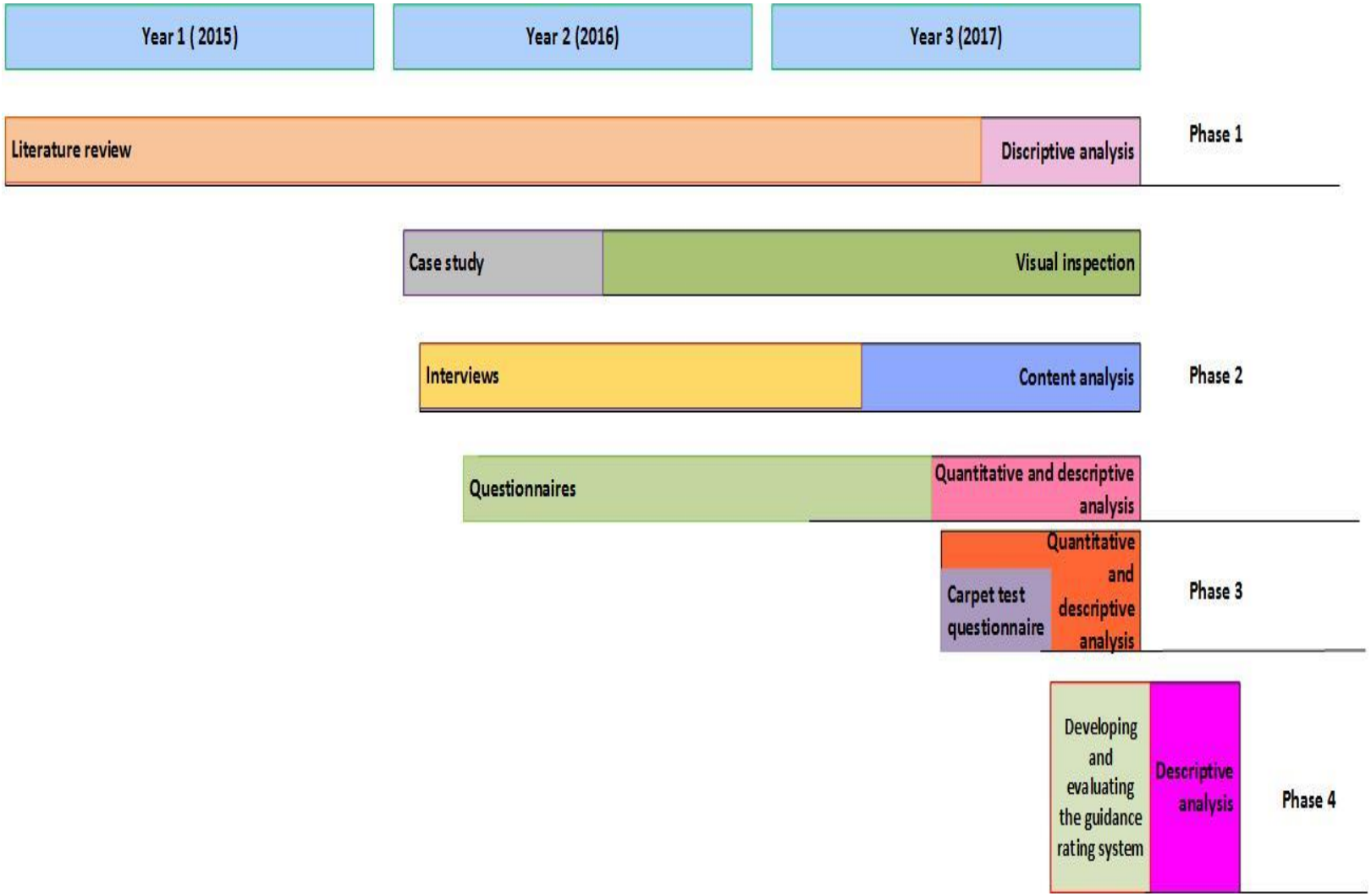


Figure 4-1 research methods, phases and conducted analysis. Source: author.

Professionals	Number	Code
Designers	**4**	**DS**
Manufacturers	**4**	**MF**
Hotel managers	**4**	**HM**
BREEAM	**2**	**BM**
Total	**14**	

Table 4-10 interviews with professionals' participant numbers and codes. Source: author.

4.2 The case study

One case study was conducted in the research project. Although the literature recommends case studies to be conducted on two hotels, the difficulties faced during the data collection stage prevented the researcher from conducting more than one case study; this is explained briefly in Chapter 1, section 1.5 and in detail in Chapter 3, section 3.7.3.1. This section will describe the case study, and analyse the data via a visual inspection of hotel photos as well as examining the carpet specifications provided by the hotel manager.

The Dorchester, 53 Park Lane

The hotel building is located in Mayfair overlooking Hyde Park, one of the most prestigious areas in the heart of London. The most upscale districts host exclusive hotels and restaurants, bespoke tailors and expensive houses. The Dorchester at 53 Park Lane is one of nine hotels in the Dorchester Collection located in Europe and the USA (Dorchester, 2017).

The Dorchester's hotel building is named after its original owner, the Earl of Dorchester, who bought it in 1792 from the Abbot and Convent of Westminster. The building was demolished in 1852 and a new building was built by the Italian architect Lewis Vulliamy, which took 20 years to complete. In 1929 the building was bought by Sir Robert McAlpine & Sons Ltd. in association with Gordon Hotels; they announced plans to create one of the most advanced luxury hotels. Again, the building was demolished to build a new one; construction completed in September 1930 and it opened its doors in 1931 (Anon., 1989).

Over the course of 87 years, The Dorchester was a stop for celebrities and royalty, which gave added value to the hotel. Guests included celebrities like Elizabeth Tayler who was a loyal costumer of The Dorchester ever since her visit to London in 1960; she kept staying at The Dorchester every time she visited London. Royalty used to dine in the hotel restaurant, attend charity balls, or dance in the hotel ballroom. See Figure 4-2 for a photo of the hotel decorated for the Queen's coronation in 1953. Figure 4-3 shows royalty attending a charity ball at The Dorchester. Additionally, The Dorchester gained the name 'the safest building in London' during World War Two, due to its reinforced concrete structure (Anon., 1989).

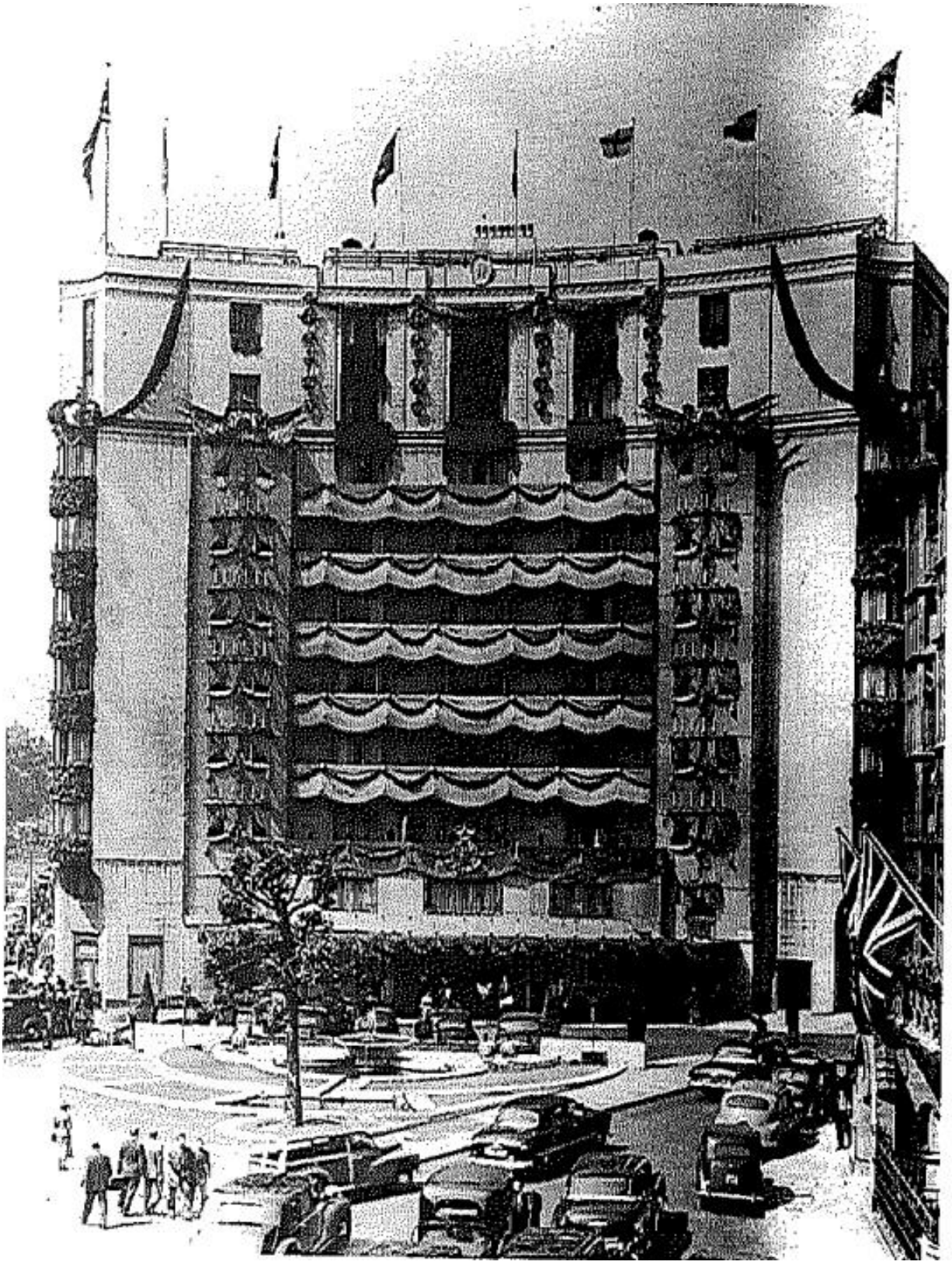


Figure 4-2 the Dorchester hotel decorated for the queen's coronation in 1953. Source: Dorchester (1989)

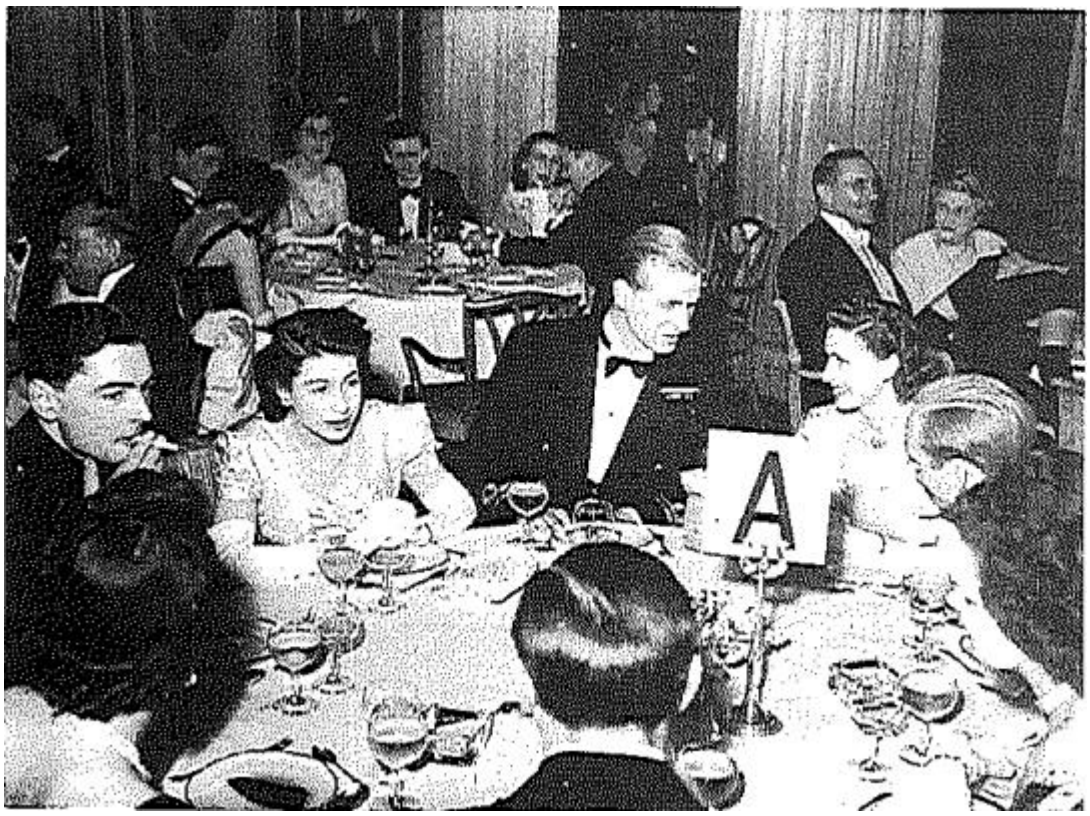


Figure 4-3 Queen Elizabeth and Prince Philip attending a charity ball at the Dorchester. Source: the Dorchester (1989)

In 1951 The Dorchester hired its first consultant designer, Oliver Ford, who was the consultant designer to Queen Elizabeth II for many years. Ford presented handmade carpets to each floor of the hotel designed with a unique floral patterns (Anon., 1989). The Dorchester's interior design has gone through several renovations by different designers such as Oliver Ford, Oliver Messel, Alberto Pinto and others over the past 87 years (Anon., 1989).

The Dorchester has 250 suites and rooms, including 182 exclusively designed guest bedrooms with king, twin or queen beds. It also has 65 suites, and three roof suites finished in a sumptuous traditional English residential style. There are 56 individually furnished suites including an art deco junior suite (Dorchester, 2017). See Figure 4-4 for a recent photo of the hotel's exterior façade.

Figure 4-4 the Dorchester hotel's exterior facade. Source: The Dorchester (2017)

4.2.1 Analysis of the case study (Visual inspection)

The hotel manager provided the researcher with the carpet specifications used in the guest rooms and suites. The carpets used in the hotel's public areas and suites are 80% New Zealand wool and 20% silk with a thickness of 12mm, while the carpets used in the standard guest rooms are 80% New Zealand wool, as shown in Table 4-2. The researcher was not allowed access to the guest rooms to take photos as the hotel manager claimed that this would not be possible due to the hotel being at full capacity. Therefore, for the visual inspection the researcher used photos of the hotel guestrooms and suites from the hotel website. These will be visually inspected in terms of the carpet used in the guest rooms and suites.

Area	Carpet materials	Carpet thickness
Guest rooms	80% New Zealand wool and 20% Nylon tufted	12mm
Suites	80% New Zealand wool and 20% Silk/hand tufted	12mm
Public areas	80% New Zealand wool and 20% Silk/hand tufted	12mm

Table 4-11 the carpet specifications used in the Dorchester hotel. Source: Churchill (2016)

- **The standard guest rooms**

The Dorchester Hotel guest rooms (deluxe king room, deluxe queen room and executive king room) as shown in Figures 4-5, 4-6 and 4-7, are fitted with a wall-to-wall carpet with a small pattern. The carpet provides the guest with comfort and warmth, allowing them to move freely inside the room walking barefoot, as well as absorbing noise to give guests the privacy they need. Additionally, as the carpet consists of 80%

New Zealand wool, it gives a feeling of softness when walking over the carpet. New Zealand wool is considered the best wool for many reasons, as mentioned in Chapter 2, section 2.4.1.4.1.

Figure 4-5 Deluxe king room. Source: The Dorchester (2017)

Figure 4-7 Executive king room. Source: The Dorchester (2017)

- **The suites**

In the suites, a wall-to-wall carpet is fitted in the bedroom area and a rug carpet in the seating area to add an aesthetic sense to the areas. The Dorchester as a five-star hotel has 65 suites, which account for more than 20% of the total number of rooms. Therefore, including all of the suites in this study was difficult. Consequently, the

Researcher included the suites that differed the most in terms of the carpet used. Figures 4-8 and 4-9 show the Belgravia Suite bedroom and seating area; the bedroom

is fitted with a wall-to-wall carpet to provide the guest with comfort and warmth while walking barefoot. In the seating area, a rug only covers the area underneath the coffee table and in the legroom area in front of the couch. The rug also provides the seated guest with comfort, as well as adding an aesthetic element to the room: we can see that it is placed to be the focal point of the room design to add an element of opulence.

Figure 4-8 Belgravia suite seating area. Source: The Dorchester (2017)

Figure 4-10 shows The Dorchester Suite bedroom. The bedroom again is fitted with a wall-to-wall carpet, which draws attention to the importance of providing the luxury hotel guest with comfort and warmth and to enable them to walk freely barefoot inside the room.

In the seating areas of The Dorchester Suite there are two carpets added, one to cover and outline the seating area, and the other to cover and outline the dining area. Both carpets have been added to outline the main important areas of the suite as well as to add an aesthetic element and warmth to the room, as shown in Figure 4-10.

Figure 4-9 The Dorchester suite bedroom. Source: The Dorchester (2017)

Figure 4-10 The Dorchester suite seating area. Source: The Dorchester (2017)

4.2.2 Findings from the case study

The case study presented here shows that adding a wall-to-wall carpet to hotel guest rooms is important to give the guests comfort, warmth and privacy, which are important elements for luxury hotel guests. The 12mm thickness of the carpet is thick enough to make the guests feel comfortable walking on it barefoot as well as providing warmth, especially in winter. Using rugs in the suite seating areas and dining areas functions to outline the seating areas and the dining areas, making them the focal point. They also add comfort and aesthetic elements as they use a mix of New Zealand wool and silk with a thickness of 12mm.

4.3 Findings from interviews

As discussed in Chapter 3, the semi-structured interviews for this study were conducted with interior designers, architects, hotel managers, manufacturers, and BREEAM members. The number of respondents totalled 14, consisting of four

designers (interior designers and architects), four hotel managers, four manufacturers and two BREEAM members. The aim of the interviews was to provide data that would aid the production of the proposed design guide for selecting luxury sustainable material finishes for high-end guest rooms using carpets as case study.

The researcher used NVIVO software to generate the main codes and sub-codes from the interview data. The analysis of the interview data is based on the responses from the four categories of professionals. Relevant quotations from the interviews are used to support the findings. Identifiers were generated to maintain the anonymity of interviewees and to provide a sense of context, in accordance with research ethics. The identifiers for the various professionals are shown in Table 4-3, which also indicates the number of respondents and the areas of expertise. The designers are identified as DS1, DS2, DS3 and DS4. The manufacturers, hotel managers and BREAM members are identified as MF1, HM1 and BM1….MF4, HM4 and BM2. The analysis of the interview data are presented in this section under the following main themes.

- Are five-star hotel guests interested in sustainable designs?
- Challenges in designing a five-star hotel with a luxury sustainable material design.
- Definition of luxury interior material finishes in five-star hotels.
- Are guests of five-star luxury hotels more interested in luxury elements, whether sustainable or not?
- The interest in luxury elements, whether it is sustainable or not.
- Factors to consider in sustainable materials.
- Rating material finishes.
- Does the hotel have a sustainability certificate?

Criteria	Identifiers	Number	Definition
Designers **(Architects and interior designers)**	DS	4	Architects and interior designers who are experienced in hotel design and/or sustainability and based in the UK.
Manufacturers	MF	4	Suppliers and manufacturers of sustainable material finishes and based in the UK.
Hotel managers	HM	4	London five-star hotel managers.
Environmental assessment organisations (BREEAM)	BM	2	The leading UK environmental assessment organisation (BREEAM).
Total		14	

Table 4-12 Interviewee codes. Source: author.

4.3.1 Transcription and analysis of the interviews

During both the face-to-face and telephone interviews, the researcher used a recorder to record the respondents. The audio files were later downloaded to the personal laptop of the researcher to be transcribed. The recorded interviews were then transcribed and ready for analysis.

After transcribing all of the interviews, the researcher went through all the interviews carefully by reading the transcripts as the first step and then started the coding by using NVIVO software to develop a set of themes and categories. This was followed by major themes being identified based on the questions asked in the interviews. Another stage followed, which involved examining the themes and categories to identify any links between them; these steps were important to analyse the raw data.

The researcher analysed the interviews data with designers, hotel managers, manufacturers and BREEAM all together under the presented themes based on the

interview questions where some of the questions are common between the four groups of respondents. The researcher will mention the related group to each theme.

4.3.1.1 Are five-star hotel guests interested in sustainable designs?

This question relates to designers and hotel managers only. Hence, the findings are based on the data collected from the two sources. In responding to this question, 78% of the respondents said that five-star hotel guests were interested in sustainable designs. It was reported that some guests were interested in low-energy lighting with low emissions.

> *"I think they may be interested in whether the lighting is low-energy, low emissions." (DS4)*

A respondent who also supported the view that hotel guests are interested in sustainable design argued that there is no need to provide some items in the guest room which might not be needed. For instance, it seems a waste to have soap boxes in the guest room since soap is only used once and replaced the next day.

> *"Some guests complain and say why you have got this box of soap... this is a waste, because it's true that with a bar of soap in a box you use it once then you throw it away; it is a waste." (HM1)*

Hotel managers maintained that nearly 30% of guests are comfortable using the same sheets for three nights. This would save the cost of having sheets dry cleaned and minimize water usage, leading to a more sustainable environment. The interest of hotel guests in sustainable design was also reported, where guests requested for the hotel to follow a green policy. A hotel manager said the following during the interview:

> *"I'd say even 20% or 30% of the clients are saying I don't think they need to do that, I'm quite happy to sleep in the same sheets for three nights." (HM2)*

On the other hand, 22% of respondents said that hotel guests are not interested in sustainable designs. Guests do not care whether the hotel used sustainable designs or

not. All they care about is their comfort in the hotel. A designer said that luxury hotel seekers are not interested in sustainability as much as the middle class is:

> *"I think it's a general thing in society as well. The middle class is more aware about sustainability and recycling – like cycling rather than taking the car – than the super-rich. So, this also applies when they get to your hotel. It's more important for them. I think the luxury market aims themselves at an audience that isn't as aware as the mid-market."* (DS3)

4.3.1.2 Definition of luxury sustainable interior material finishes in five-star hotel guest rooms

It was important to firstly gain an understanding of the professionals' perceptions and definitions of the luxury material finishes of hotel guest rooms so that these could be combined with sustainability. Furthermore, this also enabled a comparison to be conducted of the definitions of luxury goods outlined in Chapter 2. See figure 4-11.

Figure 4-11 Word cloud for 'what is the definition of luxury material finishes? Source: author, generated by NVIVO

Economically expensive

Two respondents mentioned that luxury materials are economically expensive. MF1 clarified that the more luxurious the material is, the more expensive it is:

> *"The more luxurious or the thicker the pile, the more expensive the product becomes."* (MF1)

MF2 explained that a luxury material is an expensive one that people aspire to:

> *"And what is luxury, expensive, again something that people aspire to, certainly people would love to specify"* (MF2)

a. Natural materials

Luxury materials were also defined by four respondents as natural materials which are environmentally friendly and affect the end user positively.

> *"…improve the health and well-being of a room by using materials or finishing that don't give off noxious gases, and eventually that means the person in that room has a better night's sleep."* (DS1)

Additionally, for another respondent luxury materials are sustainably sourced.

> *"…we want to know that the material is sourced from sustainable resources and that they are the finest and best materials that can be sourced."* (HM4)

b. Quality

Six respondents (MF2, BM2, HM1, HM3, HM4 and DS3) believed that one of the most important characteristics of luxury material finishes in a five-star hotel guest room is quality.

> *"I would say it's more about good quality."* (HM1)

> *"I would say it's probably the experience in the sense of quality. Quality is important for them."* (DS3)

> *"I've been in hotels where the standards of doors just seems to be much higher quality than I've seen doors in the UK hotels, but I know why, they just feel a lot sturdier, a bit heavier, shuts well."* (BM2)

Also, in BM2's opinion, a luxury item is sustainable:

> *"Something of very high quality such as a nicely finished timber door that had been responsibly and ethically sourced, and that would provide a certain function regarding fire safety security. This is because such an item demonstrates that it has a low environmental impact."* (BM2)

c. Refinement in detail

Two respondents, DS2 and DS3, added that the luxury interior material finishes for a luxury hotel guest room are materials with refinement in detail.

> *"I would say its natural materials and refinement in detail, so it's a lot about the detailing."* (DS3)

> *"It's the quality and the tactility of the material but also the detailing of it."* (DS2)

d. Social perspective

According to 50% of respondents, luxury interior material finishes are based on the social aspect of the material. It is about how it makes the user feel; it is about the look, the touch and the mood and experience they give you.

> *"It would be about the feel. So, the feel. Touching it, tactility, the visual element, what it looks like, how it all sits together and the atmosphere that it creates, the colour set, the way you create that element of luxury."* (DS4)

> *"Well I think that has a lot to do with maybe trying to find something that is unusual and something that also feels good when you touch it."* (DS2)

BM1, BM2 and DS1 believe that luxury material finishes are supposed to promote the health and well-being of the guests, so that they get a good night's sleep.

"…Connect with the senses that connect people with a sense of nature, and one that gives mental and physical well-being'' (DS1)

"In the luxury context it may be that the aesthetics actually have an overriding influence on it is indoor high-quality contribution and on health and well-being… the occupant's ability to get a good night's sleep." (BM2)

"Then there are also all sorts of other aspects to luxury about the colours and the mix of materials to give a better feel so I think there is a lot to do with the feel of the product that gives a luxury element." (DS2)

4.3.1.3 Luxury carpet specifications for a high-end hotel guest room

Designers and hotel managers were asked about their definition of a luxury carpet for a high-end hotel guest room. In seeking to produce a design guide to help designers select a luxury sustainable carpet, it is important to know what the luxury carpet specifications are, for both designers and high-end hotel managers, besides the information obtained from the secondary data.

As designers are involved in the details of selecting carpets for their projects, their answers were more specific than the hotel managers, who focused more on materials and thickness.

"We always choose to customise our carpets designed for five-star hotel projects. We focus on the quality material like we use a mix of wool and silk to make it feel soft and comfy, and we usually tend to go with a 12mm thickness." (DS2)

"It's 100% wool or silk carpets; we never choose any other different materials. It should feel comfortable when you step barefoot on it." (DS4)

Hotel managers focused more on quality, the aesthetic element and the design.

"As I mentioned before it's about the quality, the materials, as we always make sure to have the best quality of everything." (HM1)

"For us in our hotel, all our carpets are New Zealand wool mixed with silk so we can give our guests the feeling of comfort, plus we use big patterns especially for our ballroom where the patterns are big and it was customised for us to give a feeling of glamour to the ballroom." (HM3)

4.3.1.4 Luxury hotel carpet end-life

Hotel managers' respondents were asked about the end-life of their luxury hotel carpets, and what will happen to the carpet after removal? Hotel managers explained that when they need to remove the carpets, they give it to charities, or giving it to staff member or sell it to furniture companies where they clean it and resell it to smaller hotels.

*''It was sold I am going to try find you a picture of where you can see what the bedroom floors look like. And so a company came in and they bought all of the furniture, carpets, lighting fittings in the entire hotel and so they bought everything that we had. And then they do some touch-ups to it and they sell it to small hotels on the East Coast or sell them in Eastern Europe. And there were other pieces of furniture that we had that was down here on the ground floor that was sold in China. So we had cabinets that were display cabinets that were in the Piccadilly Lobby. They were sold to a shop in China that was that was setting up a British, China do like a British version of [unclear 11:08] if you like and so they bought those. Bear with me because I've thousands of photograph but I will find one in a second, so yes that's where all of the furniture when to.'' (*HM1)

''We generally would either donate them to charity or team members, members of staff can take them.'' (HM2)

4.3.1.5 Luxury hotel guests' interest in luxury elements, whether these are sustainable or not

This question was posed to designers and hotel managers to obtain their knowledge of the importance of luxury for hotel guests compared to the sustainability element.

Some respondents noted that being interested in sustainable luxury hotels is something cultural, as well as the fact that the super-rich are not interested in sustainability as much as the middle class.

> *"The middle class is more aware about sustainability and recycling – like cycling rather than taking the car – than the super-rich. So, this also applies when they get to your hotel. It's more important for them. I think the luxury market aims themselves at an audience that isn't as aware as the mid-market."* (DS3)

> *''I think it's a cultural issue and I think that if a person lives a sustainable life then maybe. But if you are a person that jets around the world staying in five-star luxury hotels you're not living a sustainable lifestyle anyway."* (DS4)

One respondent stated that clients who are coming from a company with a green focus are mostly interested in sustainable hotels.

> *"I think group clients do because companies have got a green focus in general."* (HM3)

On the other hand, one respondent thought that not all clients are interested in sustainable hotels.

> *"…I think some are yes and there is a market for that, would I say all of them no, I don't think they are most people. When looking for somewhere to stay probably they are not that concerned about where something is and what it's cost to be there."* (DS2)

4.3.1.6 Hotel owners' priority

This question was posed to designers, and aimed to find out the most important priorities that hotel owners have when working with a designer.

a. Budget

Hotel owners were concerned about the overall cost of the project. Budget is one of the most important priorities that hotel owners care about and they ask the designer to stick to this priority.

> *"Budget. The budget of how much they're going to spend to give their client the maximum amount of comfort… So how much is it going to cost me to put this suite together? And they forget about all the add-on costs that may come into that. Like project management, lighting design, import and export tax of the materials that they hadn't considered they need to import, so there are lots of things that they tend not to think about. They just want to know how much it's going to cost and how quickly you can do it."* (DS4)

Additionally, the running costs are very important for hotel owners. For instance, they are more interested now in water-saving products and LED lighting bulbs, which will save them both water and electricity.

> *"Sometimes it's also to do with the running cost of what you are providing them because it's quite important nowadays that the water efficiency of the product that you are specifying only uses a certain amount of water that meets with the operator specifications and guidelines. It could be the energy efficiency of the lighting, in some cases it might be where the materials are even coming from and what kind of certification you target.''* (DS2)

b. Hotel guideline specifications

It is very important for the hotel owner that the new design meets their hotel chain or company guidelines and should express their identity.

> *"…Meets public operator guidelines that might be someone like Hilton, they have quite strict guidelines on what things have to be…"* (DS2)

> *"A chain hotel has probably more set rules that they always offer…"* (DS3)

c. Luxury

Luxury is very important for hotel owners, especially if their hotel is a five-star hotel. As noted by one designer, hotel owners want to offer as much luxury as possible. This luxury creates the experience, which is very important in five-star hotels.

> *"I think it's the sense of luxury, it's probably the sense of quality. Obviously, like everyone else who is building they want to get as much luxury as possible for as little money as possible… I would say it's probably the experience in the sense of quality. Quality is really important for them."* (DS3)

Also, hotel owners want materials which give them a much longer lifecycle. They want durable materials from local sources: *"If you want durability, try and locally source it as much as possible from a sustainable point of view."* They do not want to have to renovate their hotels after a short time as this would not be economically viable.

d. Quality

Hotel owners also priorities the quality of materials.

"I would say it's probably the experience in the sense of quality. Quality is significant for them." (DS3)

e. Space efficiency

Space efficiency is one of the important things that hotel owners try to get from the design. More rooms mean more money, so they do not like any wasted space.

"Obviously space efficiency is very important because they probably need to get a certain amount of rooms…" (DS3)

f. Experience

Creating an experience through the design is important for hotel owners. Hoteliers want their guests to have an experience that makes them return again and again.

"The priority when it comes to design. It differs, but I think for everyone when it comes to design they want to express something. They want to express an experience; they want to provide their customers a specific type of experience. And if that's through how the staff is dressed, or how you're being treated, or special little gifts, or if it's raw materials, or if it's a theme… I think it's different, but it's all about the experiences." (DS3)

4.3.1.7 The process of designing a hotel and specifying material finishes

It is crucial to understand the main steps designers undertake when designing a hotel and the process of material selection. Therefore, this question targeted designers only where this will help in developing the design guide.

Designers shared the same main steps to undertake when designing a hotel, where the first step is starting with a brief to understand the hotel owner/s needs and overall cost or cost per room, as well as understanding the hotel standards where some hotel chains have special requirements in terms of their colour theme, style and what story they want to tell or the experience they want to give.

''As usual I like to say most processes start off with understanding the brief of the client. The kind of the needs and the wishes and the kind of extent of the projects. So we usually have workshops and questionnaires and things like that to define what they actually want and what they're setting out to be.'' (DS3)

''I mean it varied depending on how much they are doing to the hotel because it might be a soft refurbishment where they just want the existing rooms rejuvenated, and you can't change bathroom and the location of everything gets really just sort of carpet and wallcoverings and lighting and stuff like that, or it might be a full strip of everything and you have to start from scratch and redesign. So the client briefing about what they are actually wanting to achieve at the end what's their end, how do they it at the end what are they after is very important okay because then that sets you the boundary that you are going to work with them because there is no point running off and doing all sorts of things when actually they want to do that. The prices of actual design obviously it depends on you know it could be you might draw influences from place there might be a story attached to the hotel it might have a history that They want to expand or you feel it's important, and it could be the type of experience that they want to give people it might be a hotel that then is changing from a City hotel to a Spa Hotel well that's a very different story you've got to look at.'' (DS2)

''I worked at a hotel in the Middle East, but they wanted it to have this far eastern set of appeal. So you're in the Middle East, but they didn't want it to look like it was from the Middle East. You've got to really delve deeply into what it is they're looking for. That's the most important thing. I don't know where sustainability sits with that.'' (DS4)

The second step that designers take is the concept stage where they develop a design concept with different options based on the client needs, requirements and budget to present it to the client to get feedback and do changes if needed.

''And then when we ultimately define the brief, we go into the concept process and here we think of the material selection based on the client needs and requirements. Usually, we work a few weeks putting together a concept with maybe a few roots and options, options of suggested materials and colours and design, present it to the client, and then get the feedback. From there we can go and revisit things that they want to change.'' (DS3)

''Build up a sort of background story and then from that you pick what your design is going to be.'' (DS2)

The third step as DS explained is the design development where designers start checking everything after the client approve on the design concept like measurements of everything to make sure that all will fit in its place, materials, colours and lighting. Then and in the fourth step everything is confirmed to start the design detail stage.

''And then the third stage we're going to just to design development where you start checking things that they can fit to get all the measurements for things that go into the reception, or it goes into a board, amount of glasses and bottles, confirming with suppliers if they have the enough quantity of materials and furniture, You start to send and checking everything that you can actually get everything in and then it moves forward to the design detail.'' (DS3)

4.3.1.8 Challenges in designing luxury sustainable hotels

This question was posed to designers to obtain information about the challenges faced in designing luxury sustainable hotels. All of the designers had previous experience in designing a hotel, and three of them had designed a luxury hotel, but none of them had designed a luxury sustainable hotel before. Three designers had previous experience in designing sustainable residential buildings, offices and three-star

projects. Therefore, their answers to this question expressed their experiences from these projects.

A designer noted that one of the challenges in designing a sustainable project is availability of sustainable materials, and the cost of these materials.

> *"The issue probably largely comes from availability and the cost and just making sure that we can use sustainable materials that fit in with our project and making sure they are available."* (DS1)

In addition, cost is one of the challenges as well as the quality and time frame. Furthermore, convincing hotel owners is a big challenge.

> *"It's like a triangle where you have time, the cost, and the quality. And it's like you can't take any one of them out, it has to be a staple."* (DS3)

> *"Convincing the client. Just literally convincing the client. I don't think that the end user, the person who's going to use that room, necessarily would know or needs to know that some elements of that have been sustainable designed. But I think that the client is reluctant if they don't want to be seen to be— if they have a green mantra within the company then they will go along with some of it but if they don't and they want speed, they want efficiency, they want top quality for their budget, and sometimes that may mean throwing some money at it to get that luxury feel and it won't be sustainable."* (DS4)

Respondents said that durability was an important factor when choosing a sustainable material.

> *"...when you start to think about performance and outcomes you also need to think about what's the durability of the materials you're using."* (DS1)

> *"Going for durable materials was going to save money. So, speaking up regarding durability while still meeting the same performance criteria meant that the lifetime cost was better…"* (DS3)

4.3.1.9 Economic perspective

Manufacturers noted that even when the sustainable material costs a bit more than the normal material, it is worth using it to ensure it is better for the environment on the long term.

> *"There is always a way of going cheaper but cheaper doesn't necessarily mean better and it very often doesn't mean better for the environment. I think it's the responsibility of everybody, manufacturers architects and designers, the clients, main contractors, everybody, to take sustainability and put it under their wing and say right we know it's probably going to be a little bit hard, it might cost a little bit more but it's much better in the long term."* (MF1)

> *"Sustainable products are always going to be expensive and especially the luxury market."* (MF2)

> *"Generally, there is a premium I think that's the cost of producing them, the cost of producing them, the material generally is more expensive so generally speaking you can say nine times out of ten they are more expensive."* (MF3)

One interviewee added that the cost of materials in five-star hotels will be cost effective using sustainable materials but it will be higher than using it for a lodge or a three-star hotel.

> *"What you might find is the cost of materials might be higher in a five-star hotel. They're still going to be cost effective, so you still need to have the economic element within your equation, but actually, you might find that they're going to pay more. So in economic terms, they call it elasticity. So the elasticity compared to a five-star hotel might be higher whereas in an affordable hotel, low-cost hotel, you might find elasticity to pay it's going to*

be a lot lower and they might select a smaller pallet of materials to use." (BM1)

4.3.1.10Social perspective.

Some of the interviewees gave their views of using or not using sustainable material finishes in a hotel guest room.

An interviewee noted that a hotel guest room is about the quality of sleep you get in the room, and that if the material finishes are not sustainable then it will affect the user both emotionally and physiologically.

> *"It's not good for the receiver of the material, the occupier of that room, it's actually giving off gases or it's not healthy etc., then you've got to think about the social element in terms of what the receptor of that space is feeling about it. Some of that is emotional, but some of that is physiological as well… it's also about the quality of sleep you get in the rooms."* (BM1)

> *"…Volatile organic compound which is in other words like off-gassing, and off-gassing can cause what they call Asthma syndrome."* (MF4)

4.3.1.11 Luxury hotels and sustainable certification

Hotel managers were asked whether they hold any sustainable certification; if yes, they were asked what kind of certification, and if no, they were asked why not. Hotels did not have a sustainability certificate in terms of their buildings. Most of the hotels were more interested in having hospitality and tourism certificates.

A hotel manager noted that they do not hold any sustainable certification because getting this certification is difficult.

"The certification in this country is quite difficult. We are part of the Green tourism business [unclear 12:27], which is the one of the two certifiable. We can get a certificate for our sustainability as a company…" (HM2)

On the other hand, another hotel manager stated that they have the Considerate Hotelier award.

"…we've won the Considerate Hotelier of the Year award on several occasions, which is quite a well-renowned group that promotes sustainability within hospitality in the UK." (HM4)

Moreover, a hotel manager expressed their intention to get a certificate and explained their own method of being environmentally responsible, which involved using certain operational procedures such as asking their guests to decline the housekeeping service for three days and getting awarded for that.

"Not at the moment, the hotel was very inefficient before so hadn't really… I would like to apply for some of the energy efficiency ones like green key so I would like to apply for those now, we will try to do that next year… So in terms of electricity, gas and water because right now all of the showers in the hotel have all got limiters on so they only give 7 litres of water per minute…" (HM3)

"We have a programme called make a green choice where you can decline housekeeping service for up to three days, and for that you either get five points, food and beverage credit per day or you get 500 SPG points or you can donate that money to UNSF. And of the hotel about 18% of our bedrooms do that on a daily basis so they are very aware." (HM3)

4.3.1.12 BREEAM and materials rating

Manufacturers noted that they are more aware about the environment; therefore, they ensure that they are rated and hold a certificate

> *"Yes, we've got BREEAM certification, which is what we generally tend to use in the UK, all of our products are either A or A+ rated BREEAM."* (MF1)

> *"It's not really in America, they tend to go for the Greengard. In this country we tended to use the BREEAM, which is a bit more prevalent now. What we tend to find is most architectural practices and most companies that we are dealing with like high-end hotel-type chains understand the Greengard system in comparison to the BREEAM system."*

A BREEAM interviewee gave his opinion on manufacturers in terms of the impact of their materials and how they are not realistic about their materials.

> *"Most suppliers are less than transparent in terms of what their products will do and also it's not fixed, so some products, for instance, will deteriorate at a particular time."* (BM1)

BREEAM interviewees explained to the researcher about their role in rating materials and the procedure to go about doing this. A respondent noted that the first thing they do is take the carpet sample based on the manufacturer's request, and then they run a full life cycle assessment for over 60 years to understand and examine the materials that comprise the product: the source, how it is made, and the water and energy used to produce this product.

> *"My team will go to the product manufacturer and they say alright I've got my carpet tile I want to have my product assist. And then we have to do a full life cycle assessment, as I said 60 years' study period, we need to*

understand consistent materials that have gone into the product, where they've come from, how is the product made, the energy waste, water consumption for that product in the manufacturer and so on…" (BM2)

Also, they examine what will happen at the end life of the product, and then they go the manufacturer and get an assurance that what they said about the water and energy consumption is right so then they can enter all this information into a software program and run an LCA based on the BREEAM methodology; this will result in information on the environmental impact of the product. From there, BREEAM starts normalising and characterising the data and putting it into categories and then they decide if it's A– or A+ or any of the rates.

"And then some of my team then go out to the product manufacturer site and order and get the assurance that what they said in terms of waste water impact and debates that they have submitted is actually correct, then we take the data with that and we are comfortable that it is accurate back to my business and run it through some LCA software, Semipro software, we run it through based on our methodology and that's all online as well. And then that comes out with a lot of environmental impact over its life cycle, then we take obviously various steps to normalise and characterise the data and then put them into benchmark categories and then that's how we can determine whether we would say something is either an A-plus has got the lowest environmental impact across the range of over its life cycle, and then you would go A-plus would be the better performer within a benchmark category. And then E would be the worst so that's how it works so then people could specify, which is what has been happening for a long time, they will specify and say oh I want an A-plus right because that's the best type of product that you will find." (BM2)

On the other hand, a BREEAM interviewee clarified that BREEAM do not rate materials, they only assess buildings, but the owner of BREEAM, BRE run a life cycle assessment for materials if they were asked to do so from any

manufacturer and then they give each material an eco-points as mentioned in chapter 2 where this show the environmental impact of the material, and they call this the environmental profiles. Therefore, they give an environmental profile based on the manufacturer's request but do not rate the materials.

> *"Please be careful here, we do not rate materials. BRE do and they do not call it rating. They only produce an environmental profile for a product…"* (BM1)

4.3.1.13 the need of a design guide for a luxury sustainable material finishes

Respondents were asked if the design guide of a luxury sustainable material finishing would help them in designing a luxury sustainable hotel. All of them welcomed this idea. One respondent noted that this could make it easier for them as designers and would save them time looking for material specifications by forwarding the guidelines to different suppliers. On the other hand, another respondent said that the guidelines are there to help and it depends how the designer uses it and how far he can stretch it.

> *"I think that will be useful."* (BM1)

> *"Well, guidelines are there to help, they are what they say they are, guidelines, but then they are not rules so it gives you a perimeter and its how you fill it. If it's part of the design process then that's the difference between being a good designer and not, it's kind of how far you can stretch it or move it."* (DS2)

> *"Well, it would make my life easier when I get the question. If there's somewhere I could kind of—because now it's more you find the material that you like but before you present it to the client you have to forward it around to all different kind of suppliers to see if it's the same number? Do you have it?"* (DS3)

"I think it would if we have clear guidelines, if we have a clear directive, whether that be in some sort of specification document, that would really, really help because you would know then that if you put a sample forward, they're not going to accept that sample unless it meets that." (DS4)

4.4 Findings from survey questionnaires

This research conducted two surveys on different targets, and with different samples. The first survey (A) targeted interior designers and architects to investigate their interest in luxury sustainable material design guide for the selection of luxury sustainable material finishes.

The second survey (B) targeted luxury hotel guests, investigating the luxury hotel guests' interest in sustainability and what is a luxury hotel for them. Both surveys were distributed online using Google Forms. Both surveys results were meant to help in the definition of luxury within the hotel sector, as well as to determine the interest of hotel guests, hoteliers and designers in luxury sustainable hotels.

This survey was distributed in 2016 as the first step in the research data collection. Google Forms was used to administer the survey instrument to a chosen sample because the researcher was unable to reach to the respondents face to face for a one-to-one interview. Furthermore, the respondents were unable to respond to emails or phone calls, which would have been adopted as alternative means of contact. A total of 171 interview instruments were distributed through emails to design firms in London. Unfortunately, after waiting for more than three weeks, the researcher only received two responses. Therefore, the researcher decided to attend 'The Sleep Event', 'Ecobuild', in London to recruit possible respondents for the survey questionnaire. 'The Sleep Event' and 'Decorex' aim to connect the visionaries that represent concept design styles and innovation as well as define the evaluation of the hospitality industry experience. The sleep event brings together hoteliers, designers and manufacturers to discuss and exhibit the latest trends in the hospitality industry. 'Ecobuild', on the other hand, is an annual event for professionals and manufacturers in the building industry. It is an event that showcases the latest design approaches and technological advancements in building materials and construction techniques. Decorex is internationally well known for being the destination where interior design

professionals meet to discover the best and most fashionable luxury products from new, emerging and recognised talent. After identifying possible and suitable respondents at both events, the researcher presented an iPad to them for them to input their immediate responses. A total of 34 designers, comprising architects and interior designers, responded to the survey questionnaire.

4.4.1 Findings from designers' questionnaire (A)

4.4.1.1 Professional areas of respondents

The majority of respondents, representing 44% of the total number of respondents, were interior designers, while 23% were architects. Some respondents (9%) indicated that they were both interior designers and architects. Furthermore, 24% indicated that they were neither interior designers or architects. Figure 4-12 illustrates the professional areas of respondents.

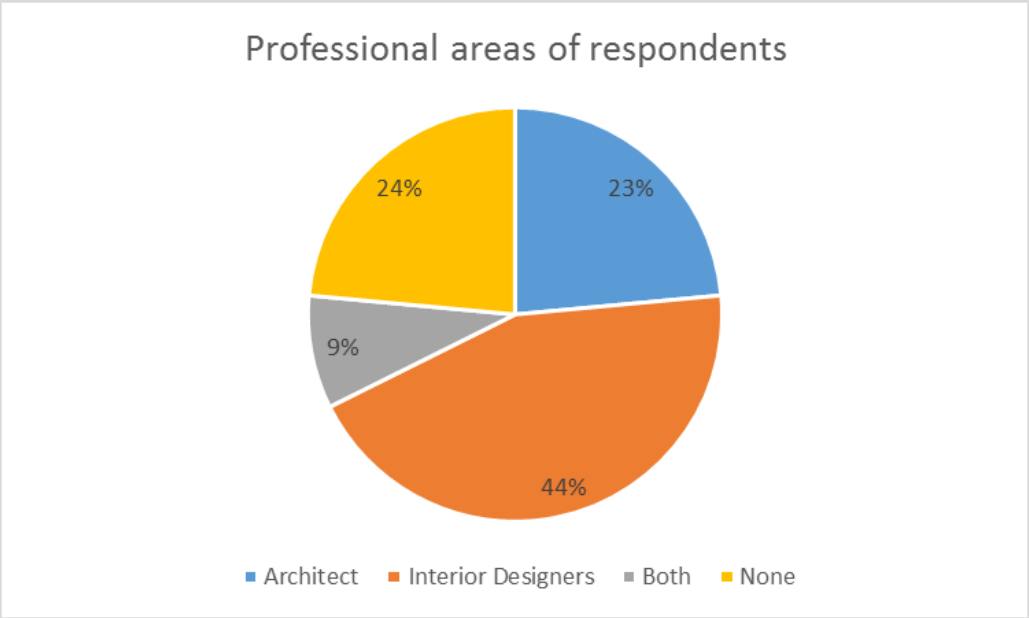


Figure 4-12 professional areas of respondents. Source: author.

4.4.1.2 Educational level of respondents

Respondents came from different educational backgrounds, with graduates forming a majority of the respondents (54.5%). 48.5% of the sample were postgraduates. Some respondents selected both the postgraduate and the professional category. This information shows that the majority of respondents had adequate educational experience to provide relevant data regarding the survey questions. Figure 4-13 shows the educational level of respondents.

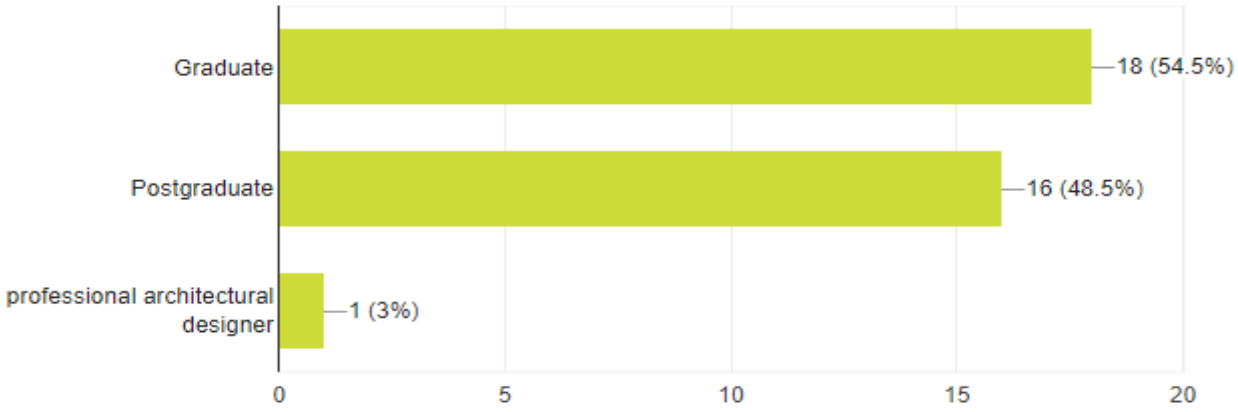


Figure 4-13 educational level of respondents. Source: author.

4.4.1.3 Type of practice

The respondents were in three categories: academic, private and public. Fifteen respondents (representing 44% of the sample) were in private practice, while 11 respondents (representing 32% of the sample) were in academic practice. Figure 4-14 shows the distribution of respondents.

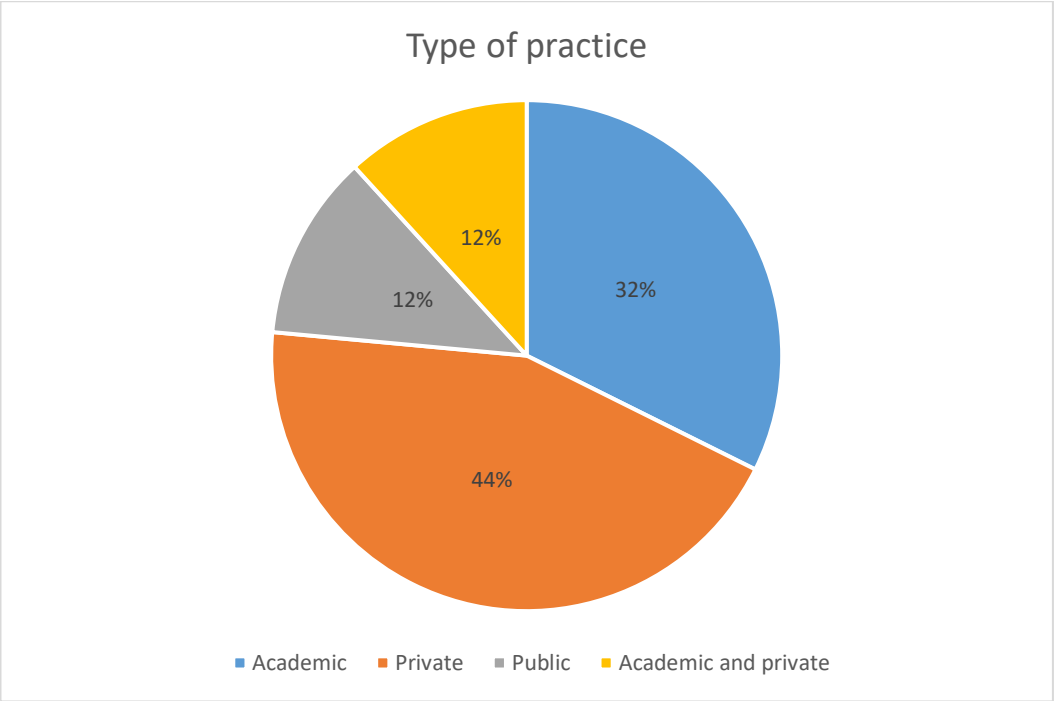


Figure 4-14 designers type of practice. Source: author

4.4.1.4Years of practice of respondents

The majority of respondents have been in practice for more than 15 years, which accounted for 41% of the total number of respondents. This shows that the majority of the respondents have a reasonable number of years of experience in the design of buildings to provide relevant information regarding the research topic. Figure 4-15 illustrates the years of practice of the respondents.

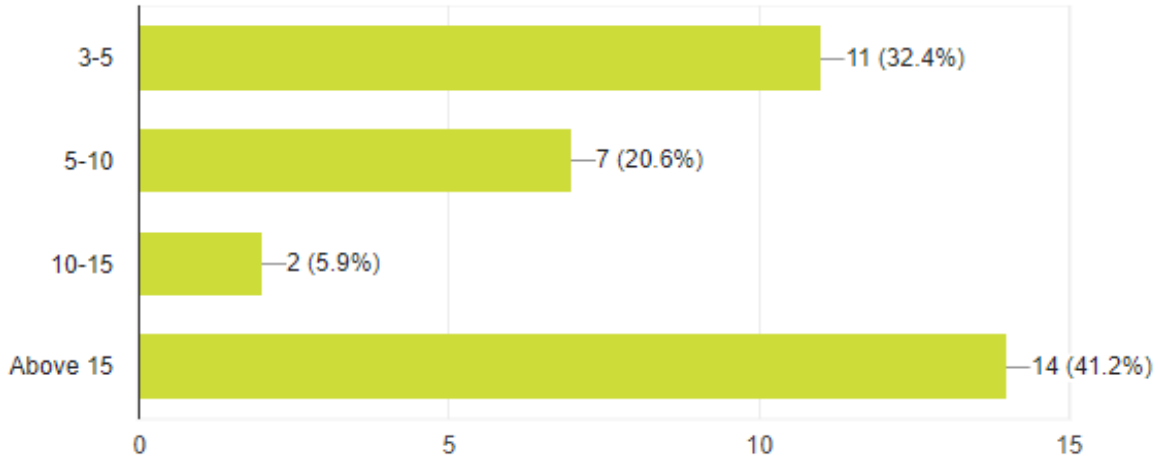


Figure 4-15 years of practice of respondents. Source: author

4.4.1.5 Involvement in designing five-star hotels

Twenty-three respondents, representing 67.6% of the sample, have been involved in the design of five-star hotels. This suggests that their responses regarding the design of hotels will be relevant to the study. Figure 4-16 shows respondents' involvement in designing five-star hotels.

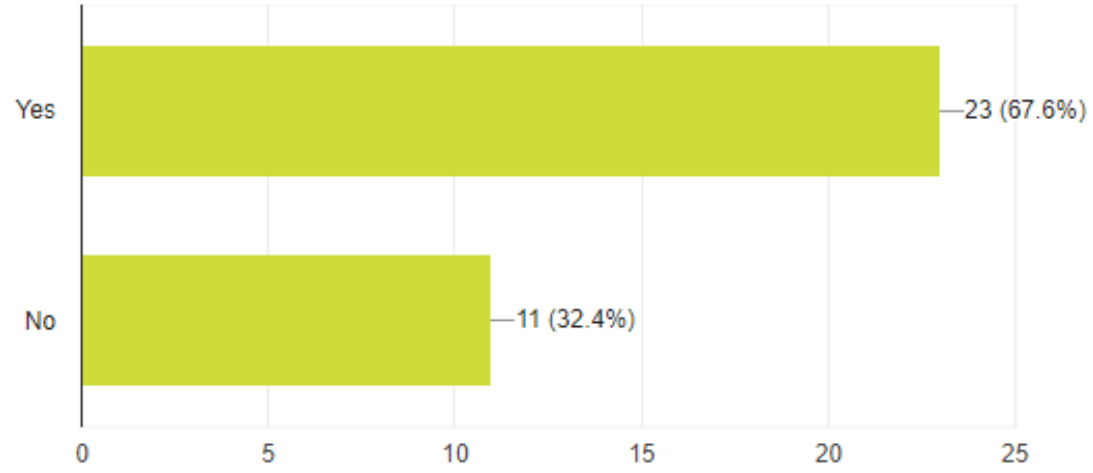


Figure 4-16 respondent's involvements in designing five-star hotels. Source: author

4.4.1.6 Hotel owners' priorities

This question was meant to determine the main priorities of hotel owners according to designers. The factors considered include lowest cost, sustainability, space efficiency, luxury and value for money. In responding to this question the respondents were given the freedom to choose more than one option. Hence, this is the reason why the percentage for all the categories exceeds 100%.

The majority of respondents, representing 66.7% of the sample, felt that luxury is the main priority of five-star hotel owners. This is followed by space efficiency, lowest cost and sustainability (representing 42.4%, 39.4% and 24.2% of the sample, respectively). Figure 4-17 illustrates the factors considered on the subject of hotel owners' priorities.

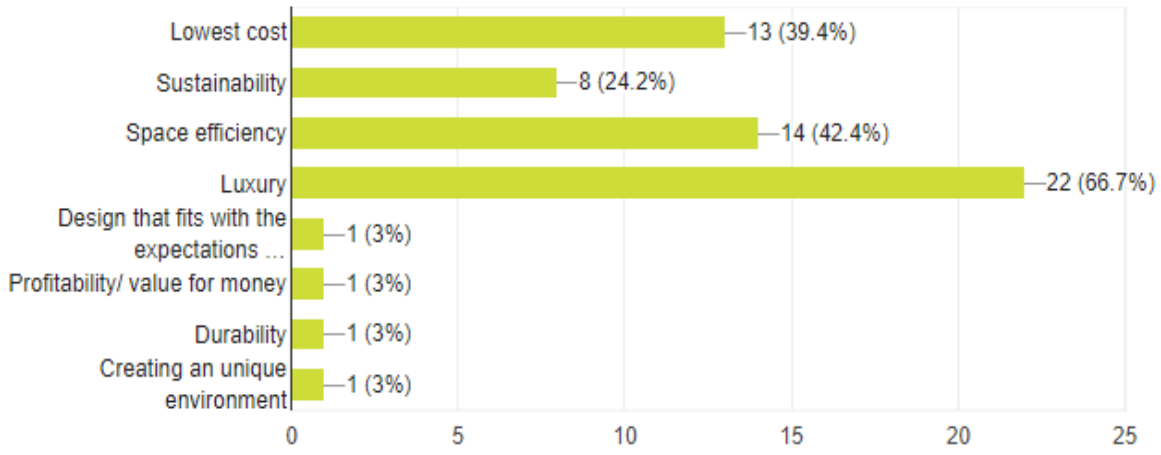


Figure 4-17 hotel owners' priorities. Source: author

4.4.1.7 Five-star hotel guests' interest in sustainable design

The majority of respondents, representing 61.8% of the sample, confirmed that hotel guests are interested in sustainable design while 38.2% stated that hotel guests are not interested in sustainable design. This indicates that five-star hotel guests are interested in the incorporation of sustainable design approaches in five-star hotels. Figure 4-18 shows the five-star hotel guests' interest in sustainable design.

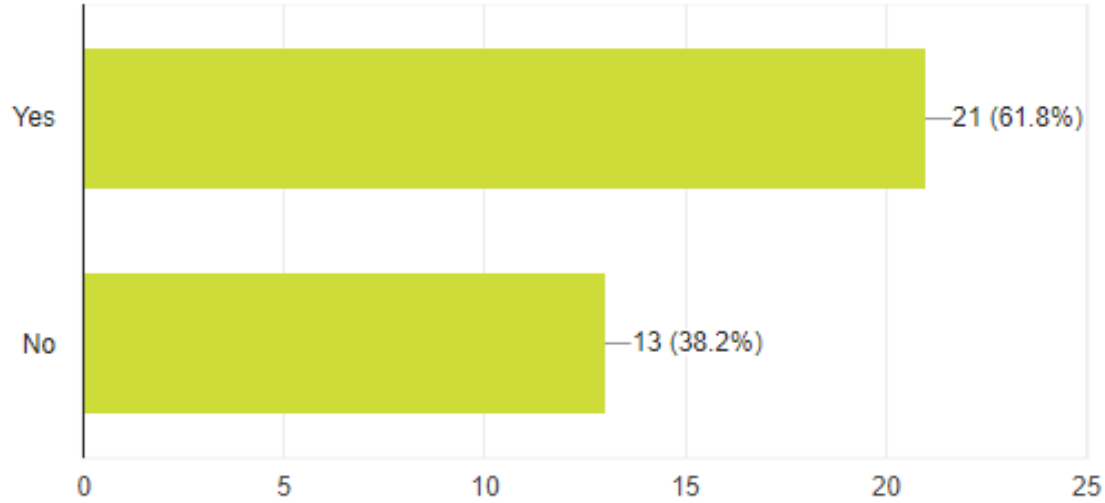


Figure 4-18 hotel guests interest in sustainable hotel. Source: author

4.4.1.8 Five-star hotel guests' interest in luxury elements, whether these are sustainable or not

The results show that the major interest of five-star hotel guests is in luxury elements, whether these are sustainable or not. When luxury and sustainability are both offered side by side, hotel guests tend to go for luxury first and then sustainability. The survey results indicate that 97.1% of hotel guests prefer the luxury elements of five-star hotels, irrespective of whether these are sustainable or not. Hence, it might be necessary to educate hotel owners and guests on how to reconcile both elements. Figure 4-19 shows the interest of five-star hotel guests in luxury elements.

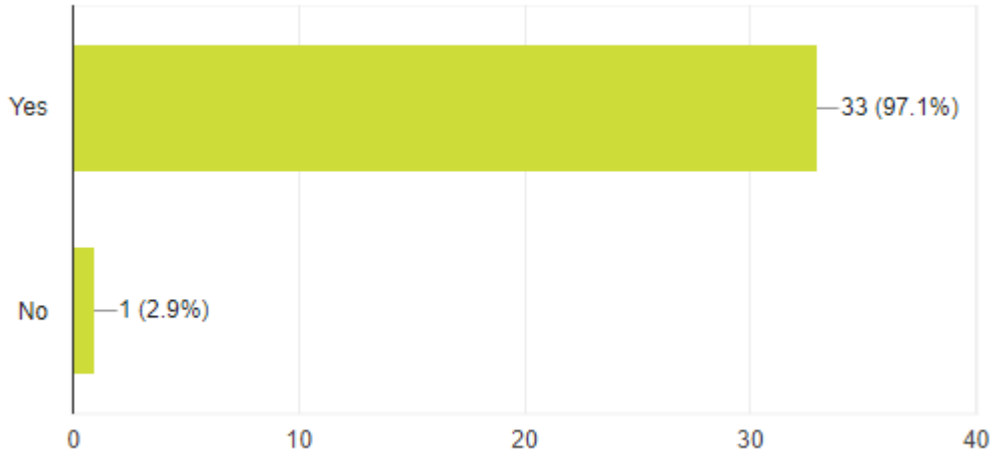


Figure 4-19 hotel guests preferring luxury over sustainability. Source: author

4.4.1.9 The definition of luxury interior material finishes for a five-star hotel guest room

This question aims at obtaining the views of respondents on the definition of "luxury" interior finishes for the hotel guest rooms. The highest percentage of respondents, accounting for 39% of the sample, defined it in terms of 'High level of detailing, premium materials and fine finishes' while 'Unique materials', 'Go beyond the standards of five-star hotel', 'Modern materials' and 'The highest cost materials' accounted for 31%, 15%, 10% and 4% of the sample, respectively. For one designer, luxury hotel guest room interior material finishes were defined in terms of 'Quality of experience'. This perspective seems to suggest that the definition of luxury is based on how it feels. Figure 4-20 illustrates the suggested definitions of luxury interior material finishes of hotel guest rooms.

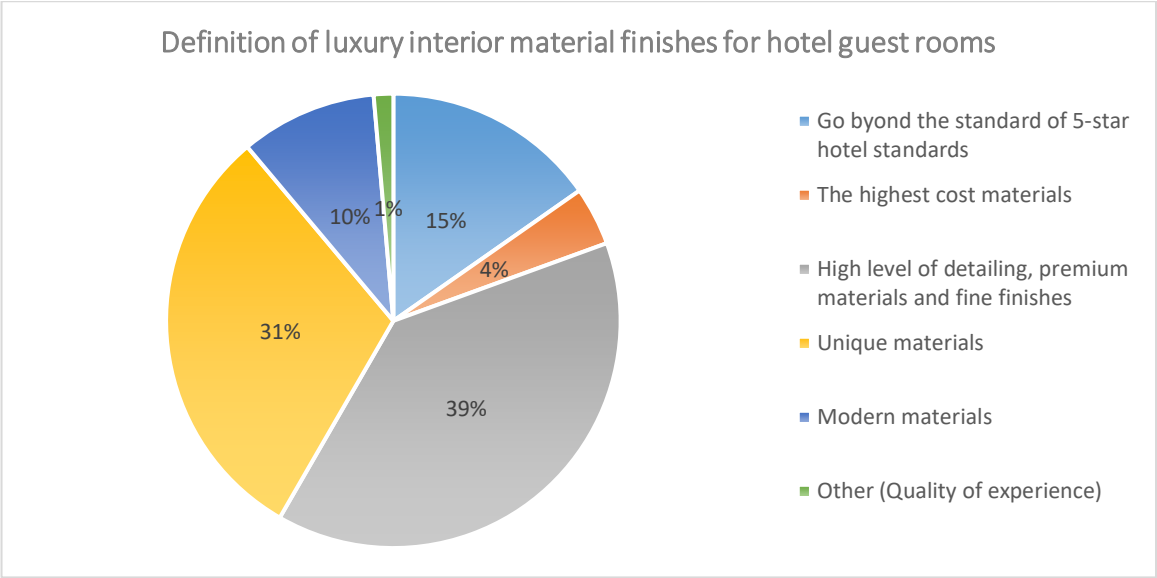


Figure 4-20 definition of luxury interior material finishes for hotel guest room. Source: Author

4.4.1.10 Designers' interest in sustainability

This question aimed to discover whether or not designers are interested in sustainability. The majority of respondents, represented by 31 designers, answered 'Yes'. Three other designers did not show any interest. Figure 4-21 shows the designers' interest in sustainability.

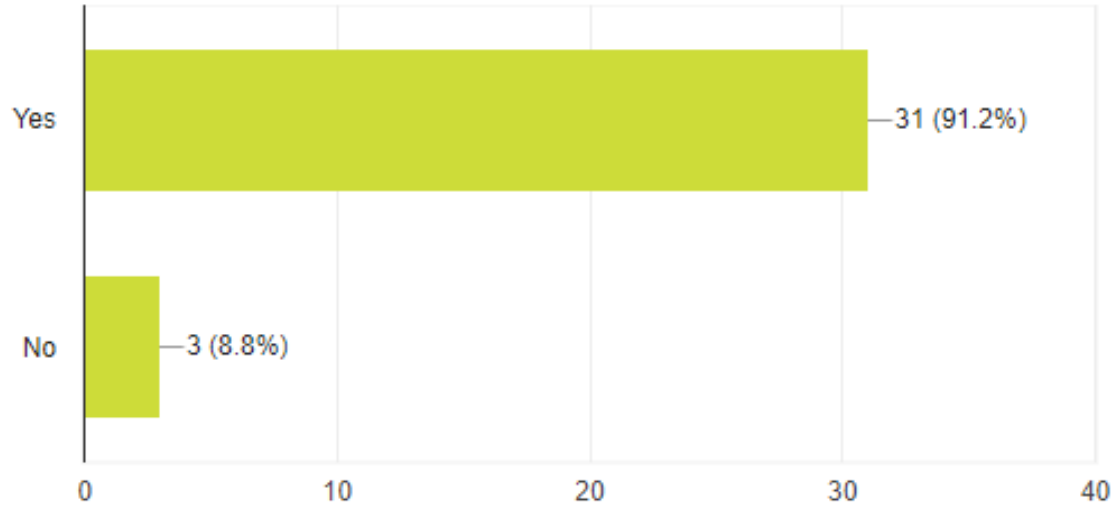


Figure 4-21 designers' interest in sustainability. Source: author

4.4.1.11 Embracing sustainable design through the selection of materials

In the previous question, 31 respondents showed an interest in sustainable design. When they were asked if they embrace sustainable design through material selection, only 23 respondents answered 'Yes'. This question was answered by 31 respondents. This indicates that some designers are interested in sustainable design but they did not bring this interest into their practice. Figure 4-22 illustrates designers' use of sustainable materials in their designs.

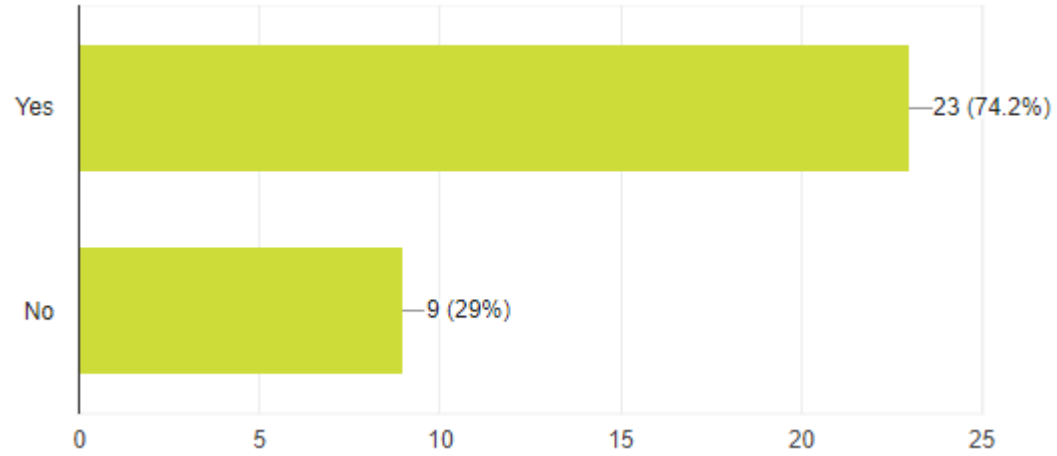


Figure 4-22 designers' use of sustainable materials in their designs. Source: author

4.4.1.12 Sustainable materials selected by designers in their design projects

This question aimed to determine what kind of sustainable materials designers use in their hotel design projects. The question is open-ended, to give the respondents the freedom to answer it without restricting their choices. The question was answered by 18 respondents out of a total of 23 who embrace sustainable design through their material selection. The 18 respondents who answered used different sustainable materials: timber FSC, wood, textile, recycled tiles, low VOC-emitting paint and LED lighting were the most repeated answers.

4.4.1.13 the challenges in designing luxury sustainable hotels

Respondents were asked to indicate the challenges related to designing a luxury sustainable hotel. This question was designed to discover the challenges faced by designers in combining luxury and sustainability when designing five-star hotels. The results demonstrate that the vast majority of respondents gave answers regarding the higher cost and limited source-book of sustainable luxury materials, represented by 28% of the sample each. Moreover, hoteliers' needs are also a challenge for designers, represented by 26% of the sample. The issues associated with quality were represented by 16% of the sample. One respondent answered with "clients do not seem that interested". This indicates that the higher cost of luxury sustainable materials and the limited source-book of sustainable luxury materials are major reasons for adopting sustainability within hotel material finishes by both designers and hoteliers. See figure 4-23.

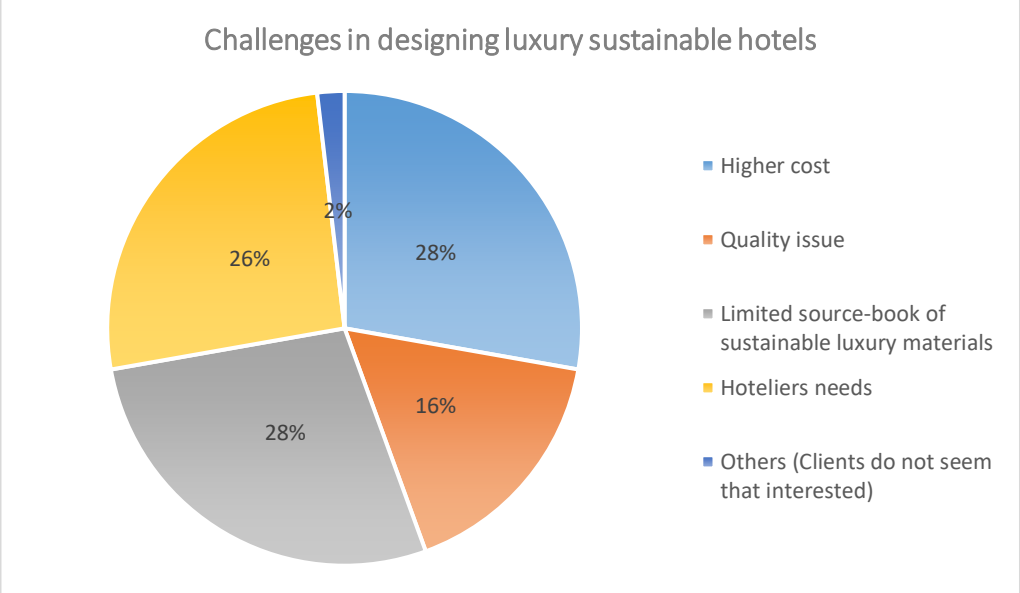


Figure 4-23 challenges in designing luxury sustainable hotel. Source: author

4.4.1.14 How a guideline/rating system of luxury sustainable materials would help designers designing a sustainable luxury hotel

Respondents were asked about how a guideline/rating system of luxury sustainable materials would help them to design five-star hotels. This question aimed to determine whether a guideline/rating system of luxury sustainable materials would assist and help designers implementing sustainability in luxury hotel projects. The question is an open-ended question to give the respondents the freedom to answer.

The majority of answers represented by the four respondents indicated that this guideline/rating system would save them time in searching for sustainable materials and suppliers.

> *"It would reduce the research time necessary to source such materials, thus making the process more efficient."*
>
> *"With a guide to sustainable materials you would not be wasting all that time searching for companies. Hopefully the guide could also act as a directory."*
>
> *"A guideline will help me to choose sustainable materials and save my time searching for suppliers."*
>
> *"It would reduce time in the specification process."*

A respondent indicated that this guide would make designers and hoteliers more interested in sustainability.

> *"It can be useful in selecting suitable luxury materials for five-star hotels that are both sustainable and meet hotel users' taste. It can enhance the*

interest of designers and hotel owners in sustainability in terms of hotel designs."

A respondent suggested that such a guideline/rating system could cause restrictions for third parties.

"The restrictions on brand standards would make a third party guide difficult to incorporate."

This indicates that designers are in need of a guideline/rating system to help them select and specify luxury sustainable material finishes for five-star hotels, and to save their time when searching for luxury sustainable material suppliers.

4.4.2 Findings from luxury hotels guests' questionnaire

As discussed in Chapter 3, this phase of the research involved an online-based questionnaire using the Google Forms website. A sample was constructed based on the criteria outlined in Chapter 3. Of this, 28 people were emailed a link to the questionnaire in August 2016, and 13 responses were received. The researcher then used Instagram, the social media application, to reach out to famous blogger accounts created for luxury travel. These accounts review luxury hotels in different countries around the world, posting photos of these luxury hotels and their experiences. Most of their hotel visits are paid via partnerships with these luxury hotels as a form of social media marketing, as these Instagram accounts are followed by millions of followers. The researcher followed these accounts on Instagram and sent them a link as a message. Of these, ten bloggers were messaged a link to the questionnaire, and four responses were received. Following this, a phase of data cleaning was carried out; a total of five responses were removed where some questions had no responses. This resulted in a final, cleaned data set of 12 usable responses. This questionnaire was essential to discover luxury hotel guests' interest in sustainability and to know their opinions about the following:

1- What are the elements they consider when they choose a hotel in terms of the guest rooms?

2- Their definition of a “luxury” guest room.

3- Their preference for a luxury-type flooring material.

4- Their preference for a hotel guest room carpet material.

5- Do they prefer sustainability over luxury, or luxury over sustainability?

The profile of these respondents is outlined below.

4.4.2.1 Gender

Figure 4-24 shows the gender distribution of the respondents.

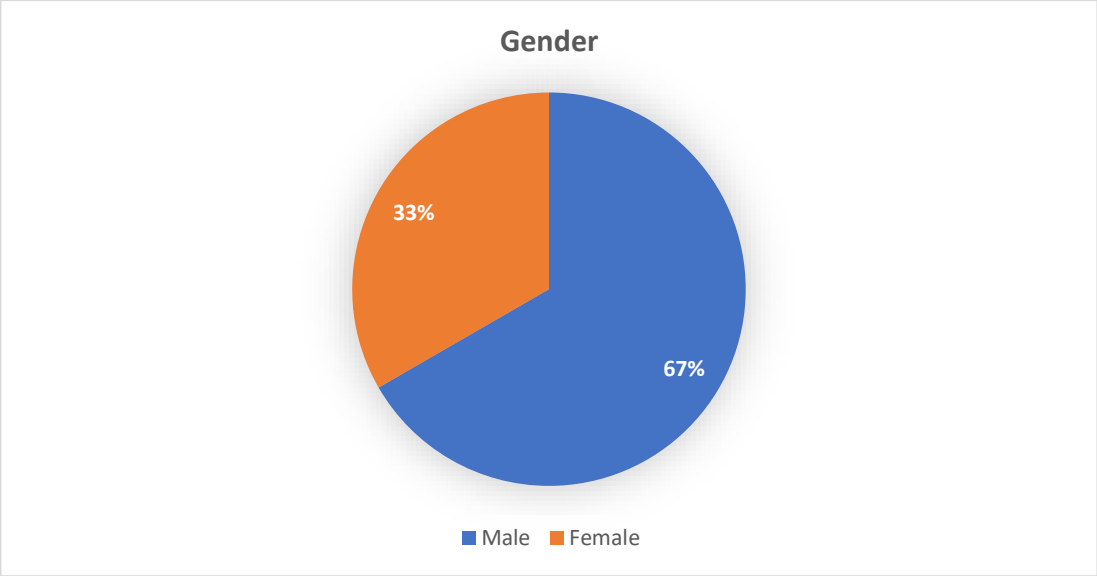


Figure 4-24 gender distribution of respondents. Source: author.

As the figure illustrates, the proportion of males (67%) was twice that of the females (33%). This is somewhat uncommon for surveys in the social sciences, where it is

usually the fact that female respondents outnumber male respondents. 4.4.2.2 Age groups

Participants were requested to select their age group from a list. Six defined age groups were created. As can be seen from Figure 4-25 below, the majority of respondents (5) were in the 55–64 age group, and four respondents were in the 25–34 age group.

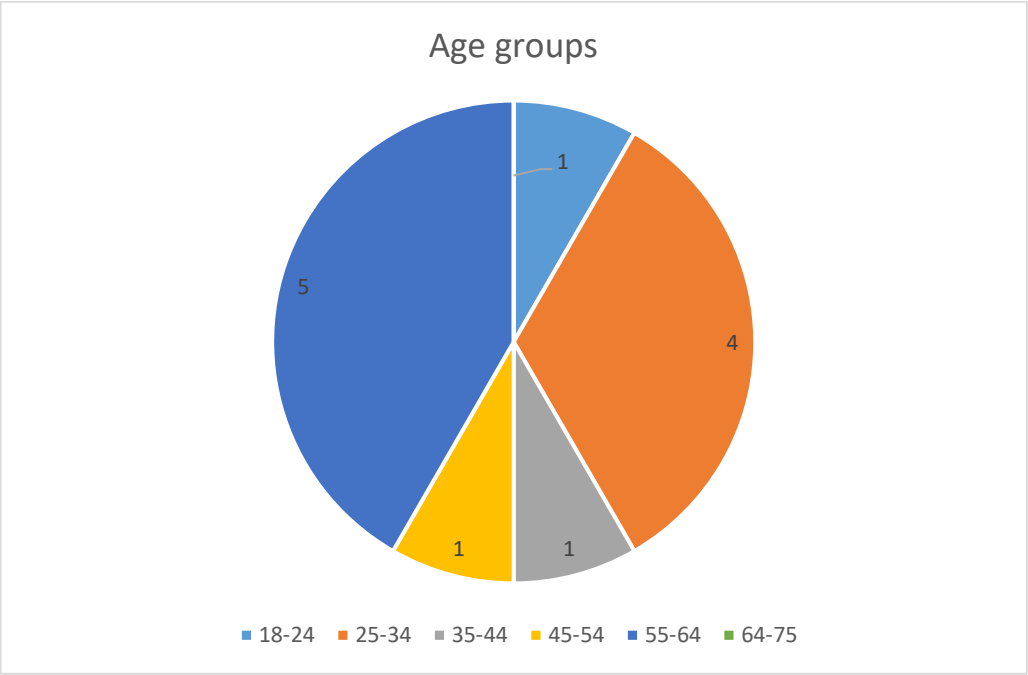


Figure 4-25 Age group distribution of respondents. Source: author

4.4.2.3 Main reasons for travelling

Respondents were asked about their main reason for travelling, usually with the aim of understanding the main reasons for travel to stay in a luxury hotel. Respondents were given the freedom to choose more than one answer.

The majority of respondents (25%) chose both relaxation and wellness and leisure equally. This is followed by 17% of respondents choosing both visiting relatives and

friends and business reasons equally. Again, attending a conference and events were chosen equally (8%). Health was not one of the respondents' choices. Figure 4-26 illustrates the main reasons for respondents to stay in a luxury hotel.

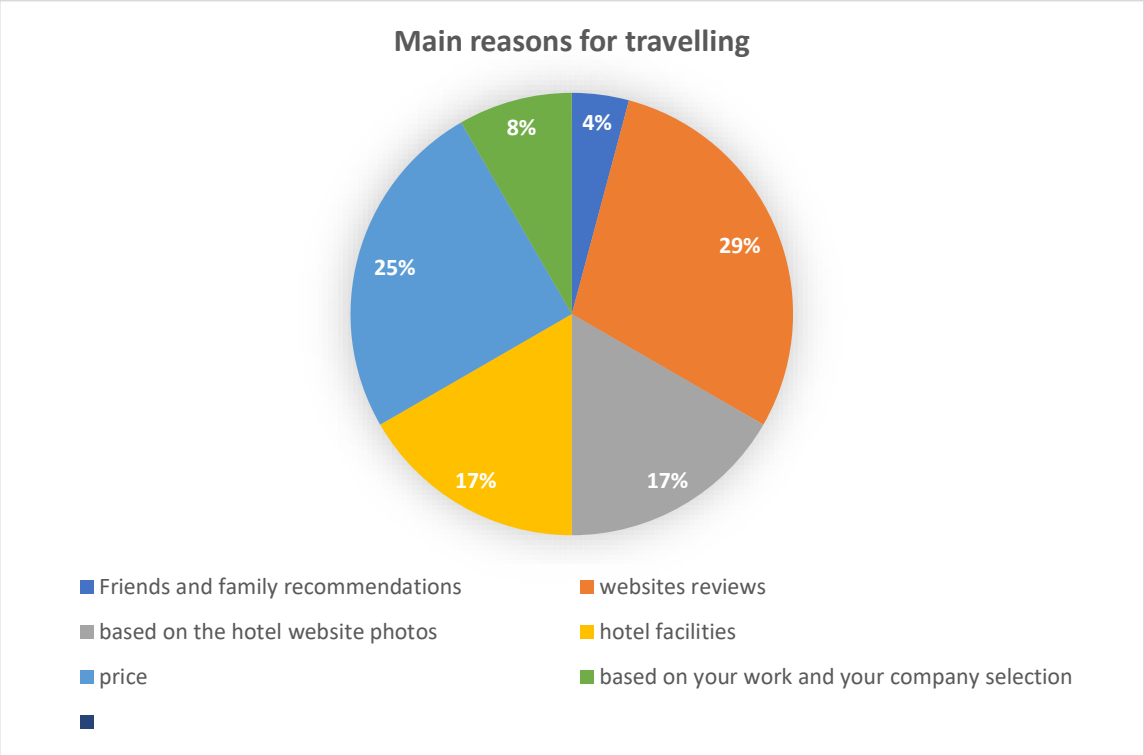


Figure 4-26 main reasons for travelling. Source: author

4.4.2.4 Selecting a hotel to stay in

The respondents were asked about the main elements they consider when choosing a luxury hotel to stay in. They were given the freedom to choose more than one answer from the list of options: hotel location, friends and family recommendations, people's reviews on websites (booking.com, TripAdvisor, etc.). This was to help the respondents to understand the question if it was not clear for them, as they could look at the options and understand the question. Additionally, providing respondents with options to choose from made it easier for them to complete the questionnaire as they would not be expected to write extensively (Bryman, 2012). Based on the hotel website photos, hotel facilities, price, based on your work and your company selection.

As can be seen in Figure 4-27, the majority of respondents (25%) chose hotel location, and 22% chose people's reviews on websites like booking.com or TripAdvisor. The third main reason was the price (19%). The proportions for hotel facilities and hotel website photos were close to each other (13% and 12%, respectively). In contrast, the based on your work and your company selection and friends and family recommendations were the least frequently selected choices (6% and 3%, respectively).

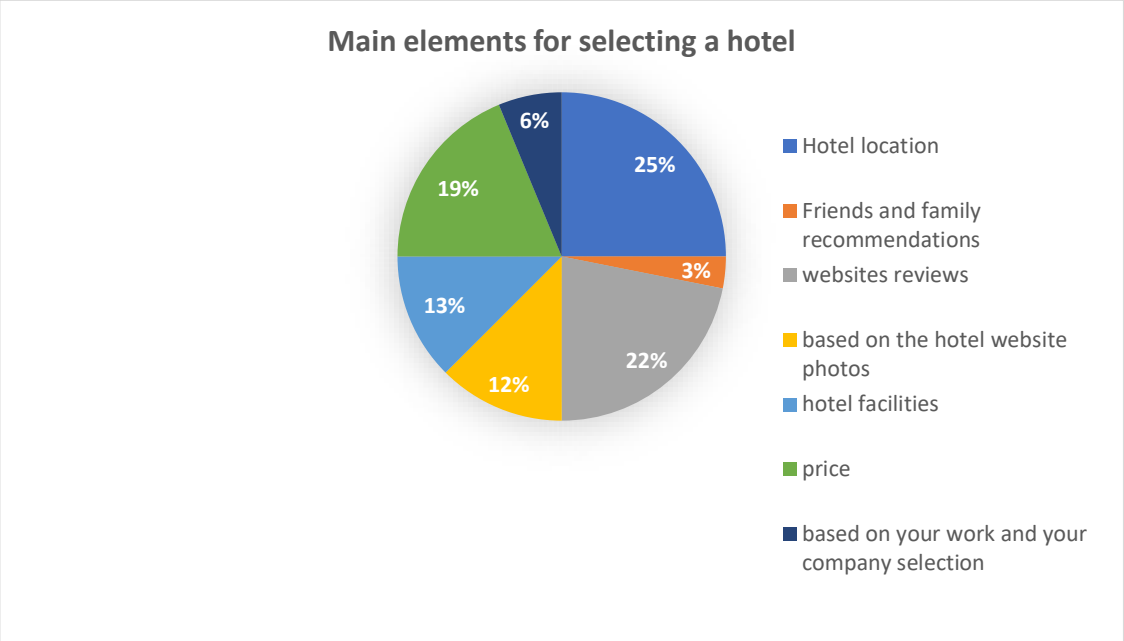


Figure 4-27 main elements for selecting a hotel to stay in. source: author

4.4.2.5 Elements you consider when choosing a hotel in terms of the guest rooms

This question aimed to obtain information on the respondents' main criteria for selecting a hotel guest room. The respondents were given the freedom to select more than one answer. The majority of respondents, accounting for 20% of the sample, were mainly interested in design quality, followed by 17% who were interested in design style. The room facilities and size of the guest room proportions were equal at 15%. Similarly, the interior design finishing materials and bathroom size and facilities proportions were equal at 13%. Lastly, colour scheme (7%) was of least interest to the

respondents. Figure 4-28 shows the main elements respondents consider when selecting a hotel in terms of the guest rooms.

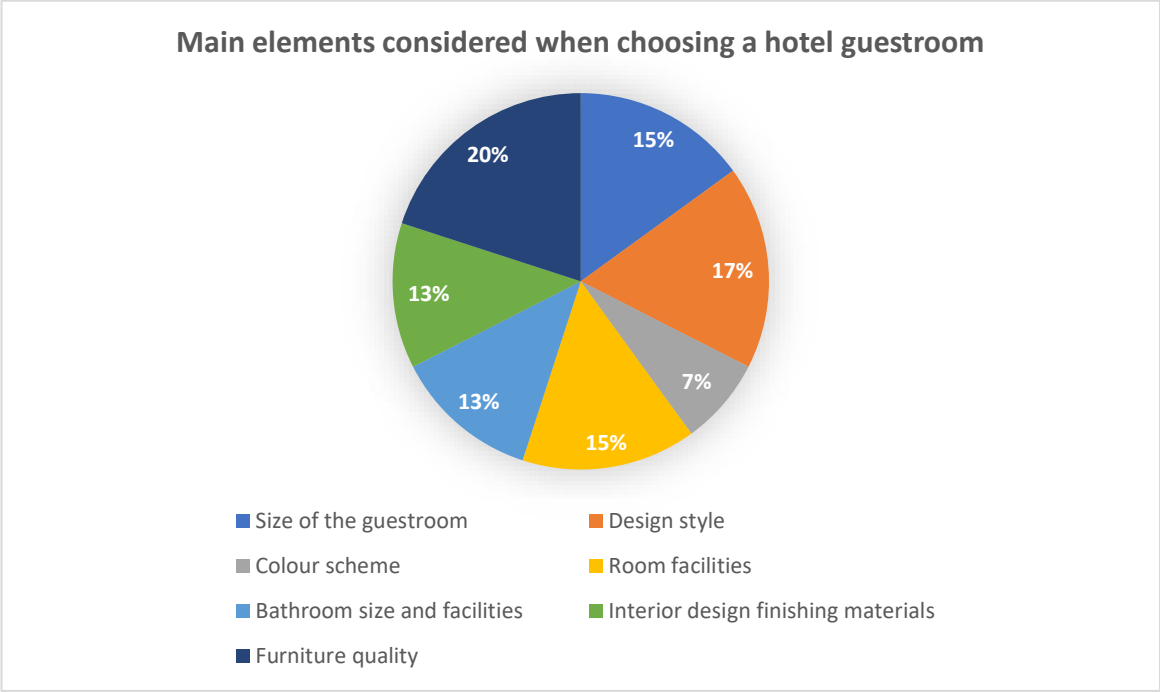


Figure 4-28 main Elements considered when choosing a hotel guestroom. Source: author

4.4.2.6 The definition of a luxury guestroom

Respondents were asked about their definition of a luxury guestroom. They were provided with the freedom to answer the question in their own words. This question aimed to obtain information on the respondents' views and opinions with regard to defining luxury guestrooms.

Respondents expressed the view that a luxury guestroom is relaxing and comfortable.

"A room that provides full comfort."

"Relaxing."

"Comfortable with outlets and Wi-Fi."

Other respondents defined luxury guestrooms as rare, executive, and exclusive.

"Executive."

"When u enter the room u say wow."

"Exclusive or rare aspects."

Moreover, luxury guestrooms were seen by some respondents as having all facilities, luxurious furniture, high-end finishes, quality and big space.

"High-end finishes, big space and quality."

"Equipped with latest amenities."

"Clean, welcoming and smart solutions. I want to be impressed and relaxed."

4.4.2.7 What is a luxury flooring material in a hotel guestroom?

Respondents were asked to select luxury flooring materials. It was deemed important to understand how hotel guests defined luxury flooring materials. This question consisted of seven options: hardwood flooring, natural stone flooring like marble, mosaic and designer ceramic floor tiles, vinyl tiles, wall-to-wall carpet, carpet with hardwood and carpet with natural stone like marble. Respondents were given the freedom to choose more than one option. The majority of responses represented by eight respondents viewed natural stone flooring such as marble as a luxury flooring material, while six respondents selected hardwood flooring. Conversely, five respondents selected wall-to-wall carpet. Figure 4-29 illustrates the respondents' definition of luxury flooring materials for hotel guestrooms.

Figure 4-29 hotel guestroom luxury flooring material. Source: author

4.4.2.8 The type of carpet material

Since the main focus in the research is on carpet flooring materials, the aim of this question was to find out which carpet materials are seen as luxurious by hotel guests. The respondents were given a list of eight choices: cotton carpet, natural silk carpet, wool carpet, art silk carpet, synthetic carpet, mix of wool and synthetic carpet, mix of wool and silk, and mix of silk and synthetic carpet. Four respondents chose the natural silk carpet as a luxury carpet. Wool carpet and a mix of wool and silk were chosen by three respondents equally, while art silk carpet was chosen by two respondents. Four choices of carpet materials were not chosen by any of the respondents, which the researcher would suggest is because respondents did not understand the other types of materials or did not think they were luxury materials. Figure 4-30 shows respondents' selection of luxury carpet materials.

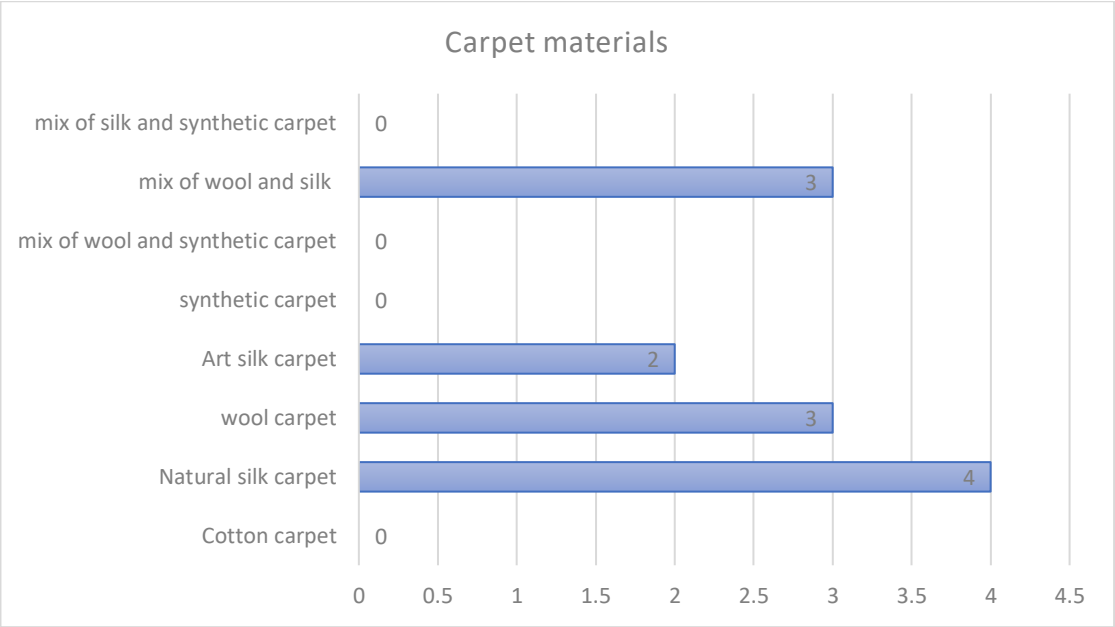


Figure 4-30 Carpet materials. Source: author

4.4.2.9 Hotel sustainable practices

Respondents were asked to respond to sustainable practices related to both hotel operational procedures and design procedures. Participants were requested to rate their responses on a seven-point measure which ranged from 1 = strongly agree to 7 = strongly disagree. The sustainable practice with the higher level of agreement was 'waste recycle', with nine respondents approving with this practice. The sustainable practice with the highest level of disagreement was 'No daily bedding change', with six respondents disagreeing with this practice.

The practice of 'using healthy and non-toxic material finishes' was strongly agreed with by eight respondents. Figure 4-31 below demonstrates the distribution of responses to the hotel sustainable practices question.

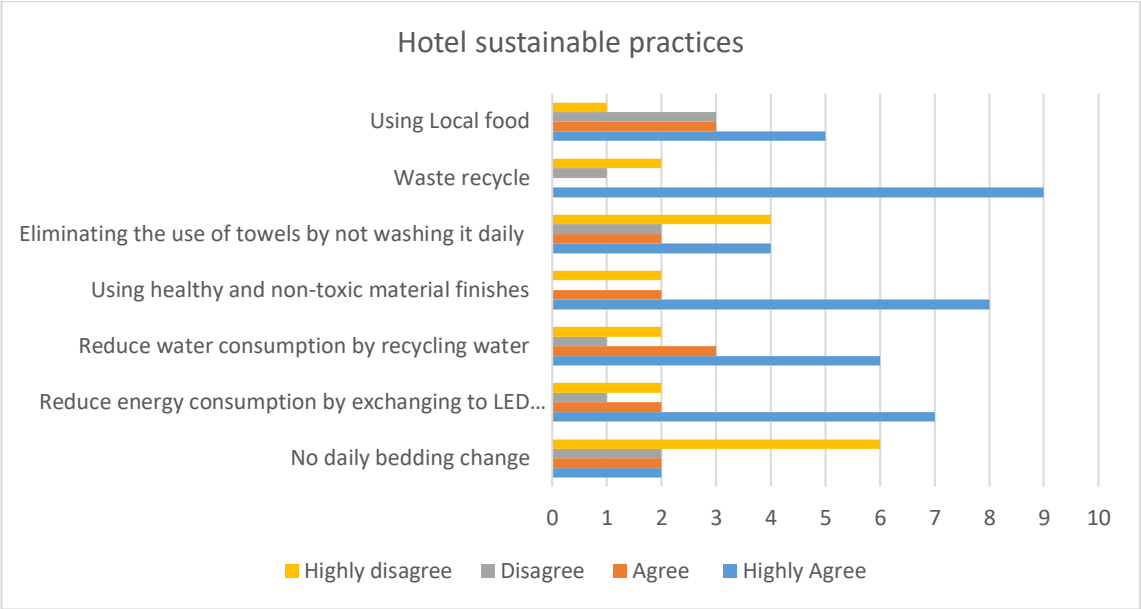


Figure 4-31 Hotel sustainable practices. Source: author

4.4.2.10 Hotel guests' interest in a luxury sustainable hotel

Respondents were asked to confirm whether or not they would be interested in a luxury sustainable hotel. The respondents were given three options: Yes, No and Maybe. The majority of respondents (92%) answered with 'Yes', which represents 11 respondents. On the other hand, 8% answered with 'Maybe', which represents one respondent. Figure 4-32 shows the respondents' interest in a luxury sustainable hotel.

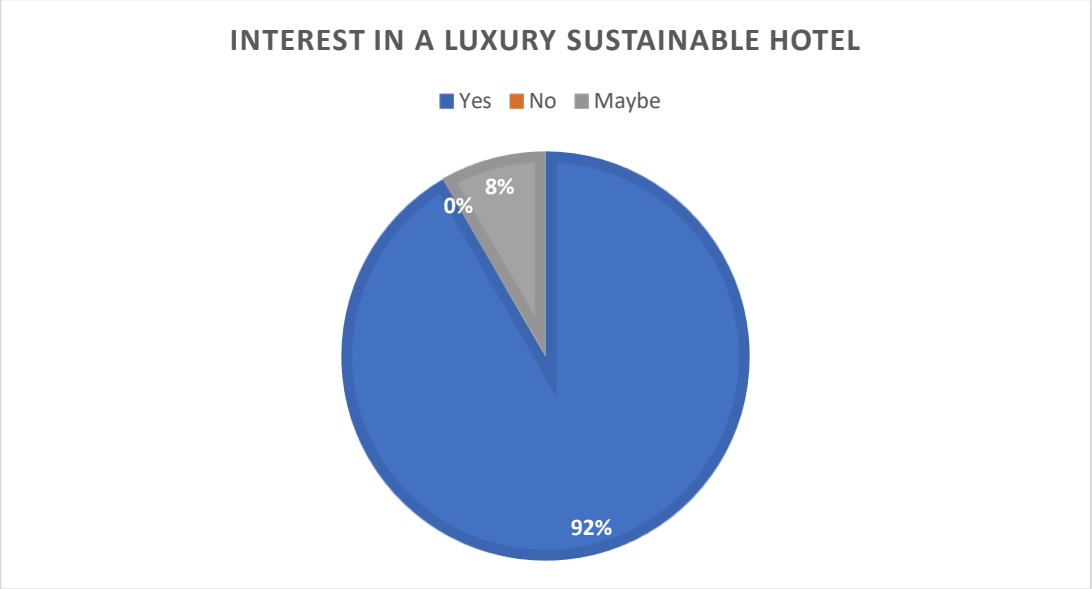


Figure 4-32 Interest in a luxury sustainable hotel. Source: author

4.4.2.11 the choice between staying in a luxury hotel or a luxury sustainable hotel

This question aimed to determine whether hotel guests are more interested in a luxury hotel or a luxury sustainable hotel. The majority of respondents (83%), represented by ten respondents, were interested in a luxury sustainable hotel. The remaining 17% of respondents, represented by two respondents, were interested in a luxury hotel. Figure 4-23 illustrates the hotel guests' interest in a luxury hotel and a sustainable luxury hotel.

4.5 Carpet test questionnaire results

This section describes the results of the test questionnaire which was administered to examine the preferred luxury carpet specifications of academics from the art and design faculty at De Montfort University. The test questionnaire variables were decided based on the results from the interviews, questionnaires and case study, as well as the findings from the literature review.

The carpet test questionnaire was undertaken in Phase 2, based on the interviews with professionals, the hotel guests' questionnaire, designers' questionnaire and the case study results.

As mentioned in Chapter 3, section 3.6.4, this test consisted of 17 carpet samples based on the results from the secondary data and interviews, questionnaires and case study results. The samples were tested by respondents looking and touching them to investigate the most preferable luxury carpet specifications for a hotel guestroom.

The test was carried out with 25 academics from the art and design faculty. The researcher provided the participants with an information sheet, consent form, questionnaire and samples catalogue. Additionally, the researcher made sure to observe each participant's reaction while doing the test, as well as recording some side notes.

This test questionnaire was analysed using Microsoft Excel.

4.5.1 Participants' background

Participants were asked to select their age group from the given list of five age groups. As can be seen from Figure 4-33, the majority of respondents (36%, 9 respondents) were in the 31–40 age group. Additionally, the 41–50 age group was represented by seven respondents, while six respondents were in the 51–60 age group. The 22–30 and over 60 age groups were represented by one and two respondents, respectively. It

should therefore be noted that the sample mainly consisted of respondents within the 31–60 age group.

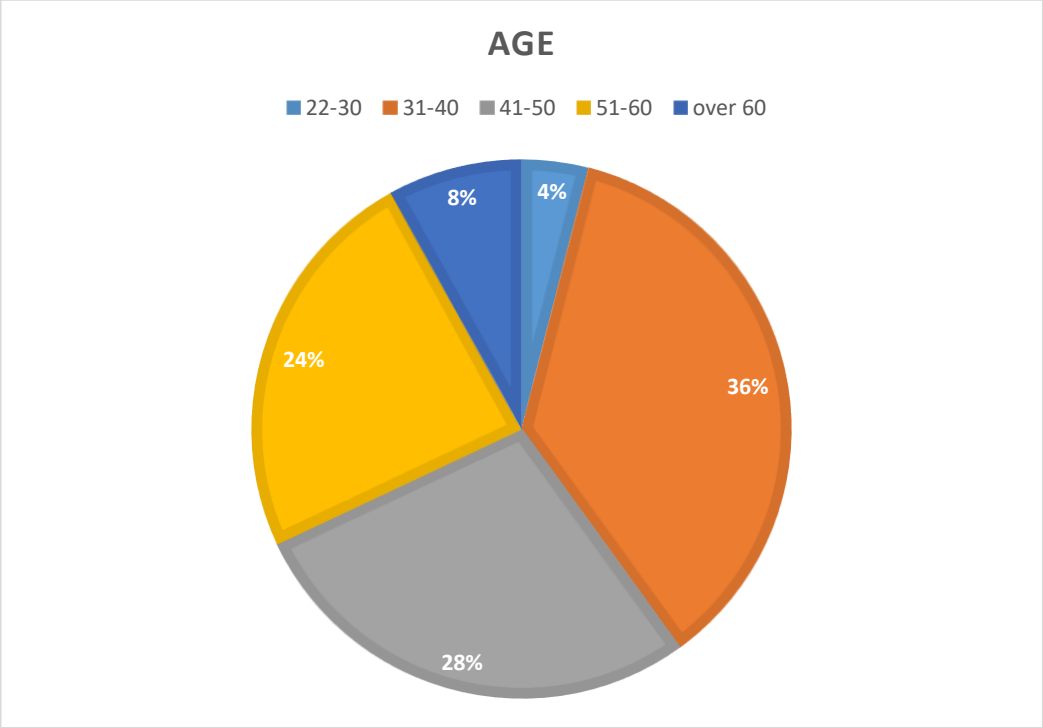


Figure 4-33 Age group distribution of respondents. Source: author

4.5.2 Academic background

Respondents were requested to choose one of ten majors of employment. The outcomes showed that over half of the participants were architects, represented by 12 respondents, while the next highest number of respondents (6 respondents) were interior designers. See Figure 4-34.

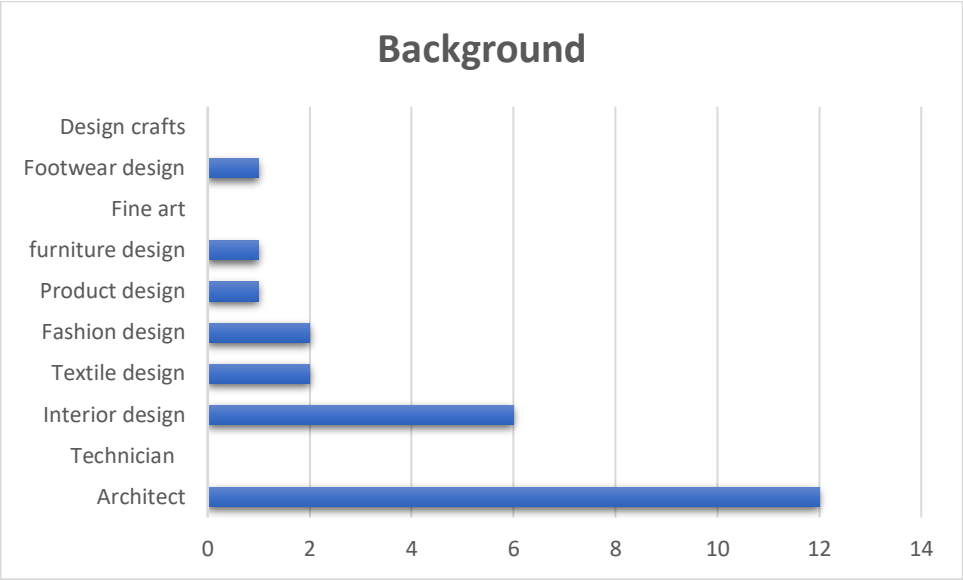


Figure 4-34 respondents' background. Source: author

4.5.3 Respondents' preferred carpet in a hotel guest room

This question was asked to respondents to ascertain which carpet they would choose based on their first impressions before starting to ask them about details. The majority of respondents represented by 24 participants chose carpet (J), which is an art silk carpet with a 9mm thickness. On the other hand, four respondents chose carpet (O), which is a natural silk carpet with a thickness of 9mm. See Figure 4-35.

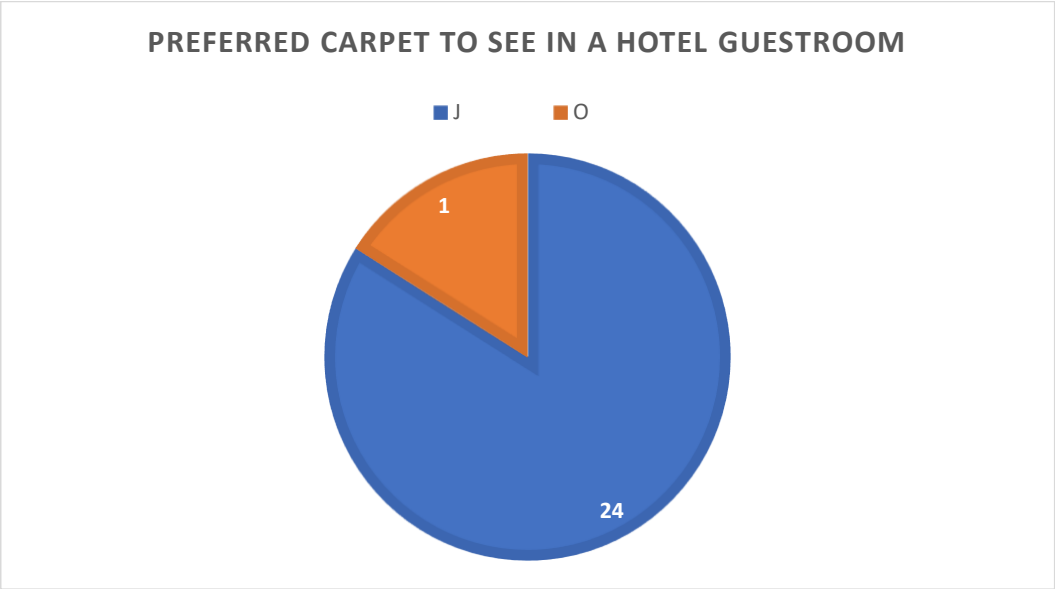


Figure 4-35 preferred carpet to see in a hotel guestroom. Source: author

4.5.4 Preferred carpet in terms of texture

This question aimed to establish the respondents' carpet preferences in terms of texture. All respondents chose the art silk carpet, carpet (J). See Figure 4-36.

4.5.5 Preferred carpet in terms of thickness

This question was asked to respondents to ascertain their preferred carpet thickness. The majority of respondents (32%, 8 respondents) chose carpet (J) with a 9mm thickness, while 28% of respondents chose carpet (I), which is a mix of wool and silk carpet with a 12mm thickness. Carpet (G), which is 100% wool with a 12mm thickness, was chosen by 16% of respondents, represented by four participants. See Figure 4-37.

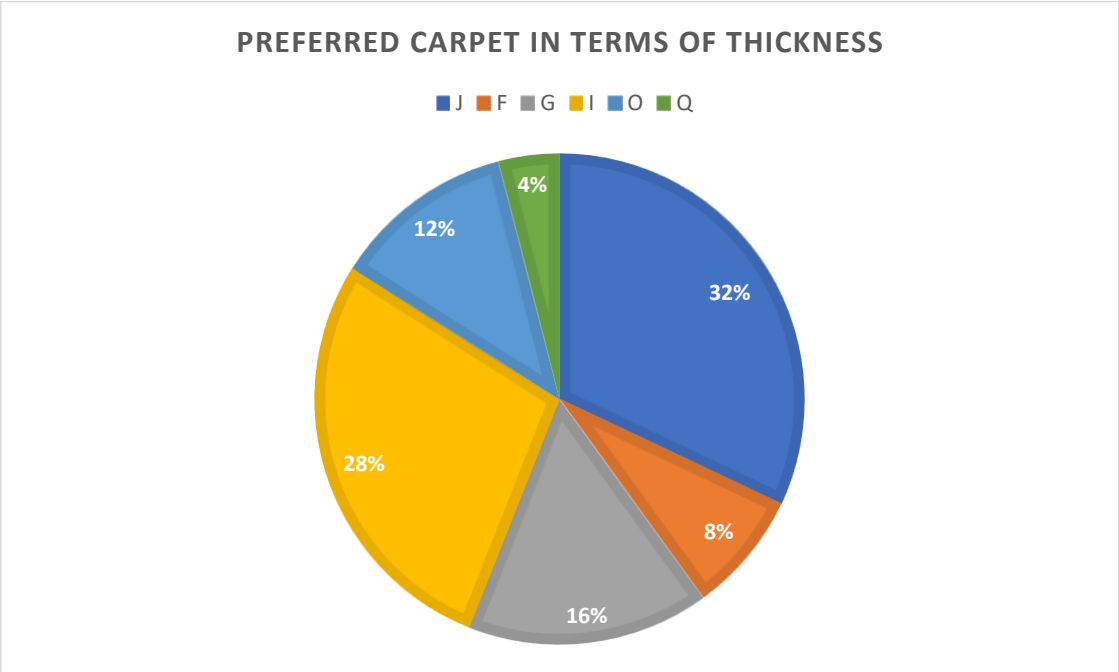


Figure 4-36 preferred carpet thickness. Source: author

4.5.6 the most sustainable carpet

Respondents were asked about the most sustainable carpets; they did not know the materials of the provided carpets as the researcher wanted to examine their luxury carpet selection without telling them the materials. Therefore, as academics with a design background, most of them (22) chose carpet (G), the wool carpet, and two respondents chose carpet (Q), which is also wool, and one respondent chose carpet (K). See Figure 4-38.

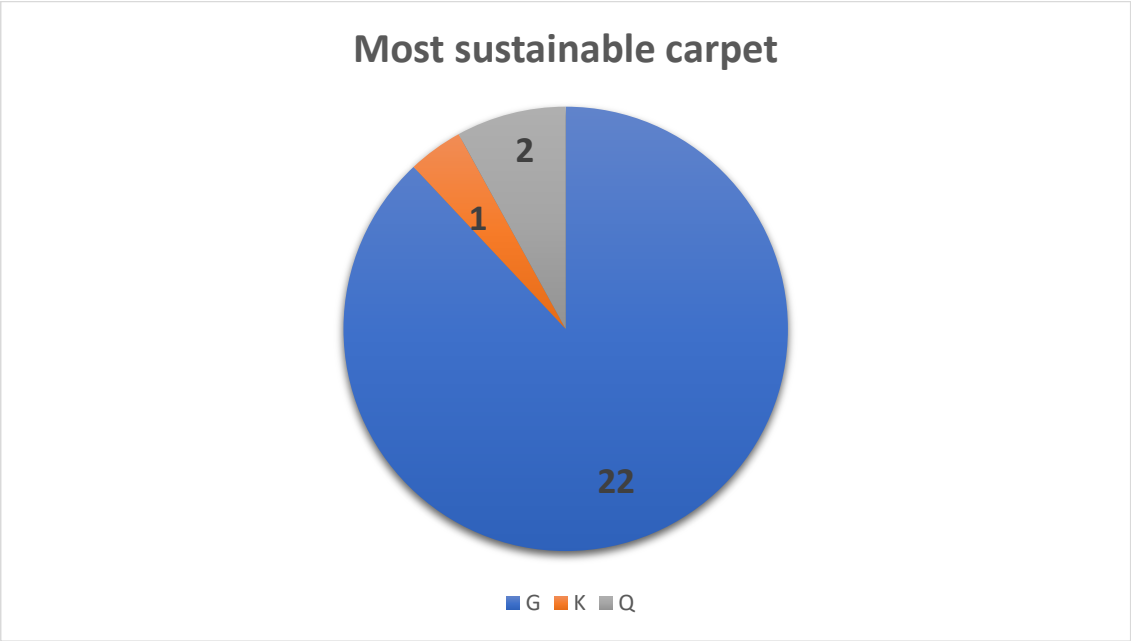


Figure 4-37 the most sustainable carpet. Source: author

4.5.7 Overall most preferred carpet

This question aimed to find out the overall most preferred carpet. Most respondents (88%) chose carpet (J), the art silk carpet, represented by 22 participants. On the other hand, carpets (G) and (O) were chosen by 1 and 2 of respondents, respectively. See Figure 4-39.

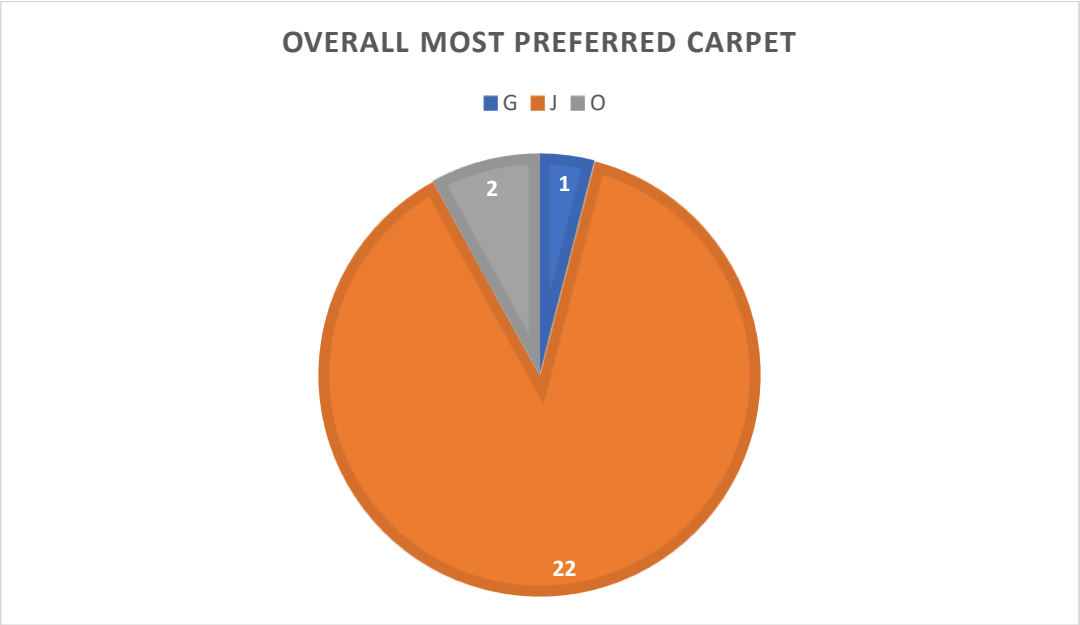


Figure 4-38 overall most preferred carpet. Source: author

4.5.8 The best five carpets

Respondents were asked to choose the best five carpets in order, where '1' is the best. The majority of respondents (94%, represented by 23 participants) gave the top ranking to carpet (J), the art silk carpet. The other four chosen carpets were carpets O, I, F and G in different orders. None of the respondents chose the same order for the five carpets but all of them chose the same five carpets.

4.5.9 Main findings from the carpet test questionnaire

As seen from the test questionnaire results, the most preferred carpet was the art silk carpet with a 9mm thickness, which is made from artificial silk. The researcher noted that respondents relied on the look and feel when choosing the carpets, by touching the carpet samples several times and rubbing them. But their decision to touch the samples came after they looked at the samples, where they noted that some samples looked smoother or thicker and these were the first samples they touched.

The respondents did not choose any of the nylon carpets which are awarded an environmental profile from BRE. These carpets look very cheap and harsh, as the

respondents expressed the first time they looked at them and touched them. Some respondents even said “I can’t even have these carpets for my car”. Respondents were more interested in how the carpet made them feel. They preferred how the silk carpets made them feel, expressing that “it is so comfy” and “I can sleep on the floor if this is my carpet”. In the second stage, wool carpets and the mix of wool and silk carpets, respondents loved the feel and the thickness of the wool carpet, but preferred the silky soft feeling of the silk one.

When it came to choosing a sustainable carpet, all the respondents chose the wool carpets with different thicknesses. This is due to their design background and their awareness of other material sources such as natural silk, art silk and nylon carpets.

4.6 Chapter summary

This chapter presented an analysis of the case study which was undertaken at The Dorchester hotel in London, together with semi-structured interviews involving designers, hotel managers, manufacturers and BREEAM members. Analysis was also conducted of the data elicited from questionnaires administered to designers and luxury hotel guests. Additionally, the chapter documented the data analysis of the carpet test questionnaire, which was conducted in stage two of the study after collecting and analysing the above-mentioned data.

It was found from the interviews with professionals that luxury hotel guests are interested in sustainable luxury hotels, as mentioned by DS4 and HM2 (see section 4.3.1.1). On the other hand, professionals stated that although luxury hotel guests are interested in sustainable hotels, they are more interested in the luxury element.

Interviewees defined the luxury material finishes of a luxury hotel guestroom mainly in terms of quality. They believed quality to be the most important characteristic of luxury, as HM1 stated. Respondents also added other important characteristics of luxury such as the social aspect, natural material, expensive and detailed. They were more specific when asked to define a luxury carpet of a five-star hotel guestroom; their

answers focused on quality materials, specifically wool and silk, as well as a minimum thickness of 12mm.

Designers explained their challenges when designing a luxury sustainable hotel. Cost is a big challenge, especially when the hotel owner is concerned about the overall budget. The availability of sustainable materials is another challenge, as DS1 explained. The same result was also found in the questionnaire with designers.

Hotel managers explained not holding a green certification relating to the building construction or the indoor environment as being due to the fact that this is hard to get in the UK. It is easier for them to get green tourism certificates regarding their green actions within their operational procedures, as mentioned by HM2 and HM4.

Hotel managers look at sustainability from one point of view, which is the financial value and how they can save money. From the questionnaire with luxury hotel guests, it is clear that they are more aware of sustainability but they still prefer luxury over sustainability.

The case study showed that luxury hotels provide comfort to their guests by using a wall-to-wall carpet within the sleeping area in all their standard bedrooms and in the suite bedrooms, mixing 80% New Zealand wool with 20% nylon for standard bedrooms and 80% New Zealand wool with 20% silk in the suites. There is a 12mm thickness for all carpets and rugs used in the hotel to provide guests with comfort and warmth while walking barefoot in the bedroom. The mix of New Zealand wool with silk gives the guests a feeling of softness when walking on these carpets and rugs, which helps them to feel more special as a luxury hotel guest, where it is all about experience.

The carpet test questionnaire focuses on the results from the luxury hotel guest questionnaire. The academics in the carpet test questionnaire also prefer luxury over sustainability although what is sustainable is not their top choice of luxury carpet. The results of the carpet test questionnaire showed that people tend to touch the carpets that they liked when looking at the carpets. They first touch the carpet which looks softer; therefore, the best carpet was not the thickest one but the softer one with an artificial silk material which is softer than natural silk. The test questionnaire helped

the researcher in deciding on the main elements which could help designers in selecting and specifying a luxury carpet.

The analysis of the primary data and the secondary data confirms the need for this research, and will also help in developing the guidance rating system in the next chapter.

CHAPTER 5

Chapter 5: Development of the Design guide

5.1 Introduction

The focus of this research is the development of a design guide to help designers select luxury sustainable material finishes for high-end hotel guestrooms, using carpet as a case study. This design guide will be treated in terms of two criteria: luxury and sustainability (existed data from BRE environmental profiles), where the main focus is developing a luxury rating system for carpet in high-end hotel guestrooms to combine it with the BRE environmental profiles where this will help designers to select a luxury sustainable carpet for a sustainable high-end hotel guestroom and provide guests with the comfort and luxury they seek for when staying in a high-end hotel, also hotel owners can tick one box towards being certified as a sustainable hotel. Therefore, the design guide strives to guide designers, hoteliers and manufacturers to effectively combine sustainability and luxury to produce healthier luxury hotel guestrooms.

However, the development of the design guide was informed by the findings from the literature review and primary data which was collected from the various methods adopted in this study as presented in Chapter 4. This chapter provides an insight into the process of developing the design guide starting with section 5.2, which focuses on the rationale for the development of the design guide. Section 5.3 gives an overview of guidelines, while section 5.4 describes the proposed design guide and the stages involved. Section 5.5 present the initial evaluation of the design guide and suggests future work that could be done to enhance it. This chapter ends with the conclusion in section 5.6.

5.2 Rational for the development of the design guide

The proposed design guide for luxury sustainable carpet for high-end hotel guestrooms was first conceived from the research gap observed from the literature review. It was established earlier in this study as Máté's (2006) study outcome showed that interior designers lack confidence and information regarding to sustainable materials in general, and the sustainable materials that can be provided by suppliers. Additionally, Kang and Guerin (2009) revealed that sustainable interior finishes were less frequently applied than any other components in sustainable design, and that interior designers were not aware of the life cycle of interior materials. For this observed gap regard interior designers selection of sustainable material finishes and others as mentioned in the literature review and the primary data, where the designers interviewed in this study highlighted the need for a design guide to help them select luxury sustainable material finishes for their projects, especially where their clients needed luxury material finish, which can limit their options if they want to design sustainably. Moreover, designers complained of difficulty understanding current eco-tools like BREEAM, as well as its inability to address the subjectivity side of materials, which is the most important consideration for their clients. Hence, this study set out to develop a design guide that will help designers to produce sustainable, healthy and luxury indoor environments for high-end hotel guestrooms which can then be developed and applied for other building industries.

5.3 An overview of guidelines

Despite the usage of guidelines, standards and rating systems in previous studies, there seem to be confusion over their meanings and usage. This may be due to the lack of definitions of these terms in published research works. Fowler and Rauch (2006, p. 1) defined sustainable building rating systems as "tools that examine the performance or expected performance of a 'whole building' and translate that examination into an overall assessment that allows for comparison against other buildings". Fowler and Rauch (2006) revealed that after reviewing 30 building

tools/systems, they found that most of them are not meeting the rating system definition they have set, or the basic requirements of a rating system. RSMeans (2011) explains that standards, guidelines and rating systems related to buildings are divided into two groups: those that relate to the whole building and those related to specific components within the building, citing the LEED rating system as an example of a whole building (multiple attribute) rating system, and ENERGY STAR an example of a rating system focusing on a specific component of the building (single attribute). Allione et al. (2012) explains that eco-tools have been created to help designers to achieve an eco-product, where these eco-tools are based on the analysis of the environmental performance of these products or materials. Han and Kim (2014), who seem to support this view, state that the main aim of guidelines is to encourage the practice of designing sustainable buildings and raise awareness by providing building professionals with information, but this does not prevent each guideline from being designed for a more specific objective, besides the main one. Han and Kim (2014) classified the main purposes of guidelines as follows:

- to inform and educate professionals and public on the importance of sustainable buildings, and a provide better understanding of sustainable buildings principles
- to deliver professionals with detailed information about sustainable building strategies and technologies
- to help professionals making decisions in sustainable building design, operation and construction
- to help professionals checking compliance with buildings code and standards.

Allione et al. (2012) explains that there are two kinds of eco-tools: quantitative and qualitative. The quantitative ones are based on a theoretical background of LCA and based on the phases of LCA, these tools provide and identify the main impacts in relation to environmental consequences. The qualitative eco-tools like guidelines, material libraries and eco-strategies provide designers with general or specific information about materials and their production, or they provide designers with best practice suggestions which can be followed to minimise the environmental impact of a

product or a material throughout its life cycle or through a specific phase (Allione, et al., 2012). According to Allione et al. (2012), quantitative eco-tools are not useful throughout the concept and product design when designers are directly involved, due to the large amount of data needed to run an LCA that is not available in the concept stage. Additionally, LCA is a time consuming process. On the contrary, qualitative eco-tools like guidelines are very useful for designers in the concept and product design steps, where they can help to inform decisions at an early stage. Therefore, designers will be able to make the right environmental decisions. Allione et al. (2012) focuses on three categories for the material selection phase to help designers make the right choices: materials with low environmental impact, the ability to extend the material's end-of-life phase, and the ethics and policies of the manufacturer. This research focus is on combining both qualitative and quantitative eco-tool, to create a guidance rating system that can equip designers not only with information about the environmental impact of a material, but also with the appearance of the material.

Guidelines can be found online, in printed documentation and in software tools (Han & Kim, 2014). According to Han & Kim (2014), these guidelines and their hierarchies of data may vary from one to another depending on the aim of each guideline. Guidelines may take the form of a brief or detailed manual, but good guidelines have a well-designed data hierarchy to lead users through the content in line with importance and need (Han & Kim, 2014). In addition, Han & Kim (2014) state that sustainable building guidelines can be used by a variety of groups, including professionals (designers, engineers and construction workers) and building owners.

Considering the two kinds of eco-tools (qualitative and quantitative), the researcher proposed a design guide combining both to link between the subjectivity (luxury) and objectivity (sustainability) of the carpet used for a sustainable high-end hotel.

5.4 The proposed design guide

The main aim of this research is to develop a design guide for luxury sustainable material finishes for sustainable high-end hotel guestrooms, using carpet as a case study. This section presents the development of the design guide and an overview of the major three stages, leading to the proposed design guide and the initial evaluation.

5.4.1 The development of the design guide

The design guide would not be complete without the support of three main factors: the existing BRE environmental profiles (which are part of BRE's guide to specifications), this study's literature review findings and the primary data findings revealed through the adopted methodology. The decision to develop a design guide for luxury sustainable material finishes was generated as a result of the knowledge gap discovered by reviewing the literature regarding luxury sustainable hotel guestroom material finishes in London, (see Chapter 2). The researcher has integrated these three factors (see Figure 5-1), in order to develop the proposed design guide.

To design the design guide, it was necessary to explore the relevant requirements. Hence, designers, hotel managers, manufacturers and BREEAM leaders were interviewed and luxury hotel guests provided data through the online questionnaire, where this important data informed the development of the design guide. The interviews with designers in London provided information in areas like the approach to selecting luxury sustainable material finishes for high-end hotel projects and the challenges of designing luxury sustainable hotels. Luxury hotel occupants provided data on their preferred luxury flooring material in high-end hotel guestrooms, and their preferred luxury carpet material. The findings from interviews and questionnaires informed the design of the carpet test questionnaire, which also played an important role in providing information about the specifications of a luxury carpet for a high-end hotel guestroom. These findings, alongside those from literature review, informed the development of the design guide. Hence, the design guide is a combination of both

subjective and objective issues related to luxury and sustainability of hotel guestroom carpet.

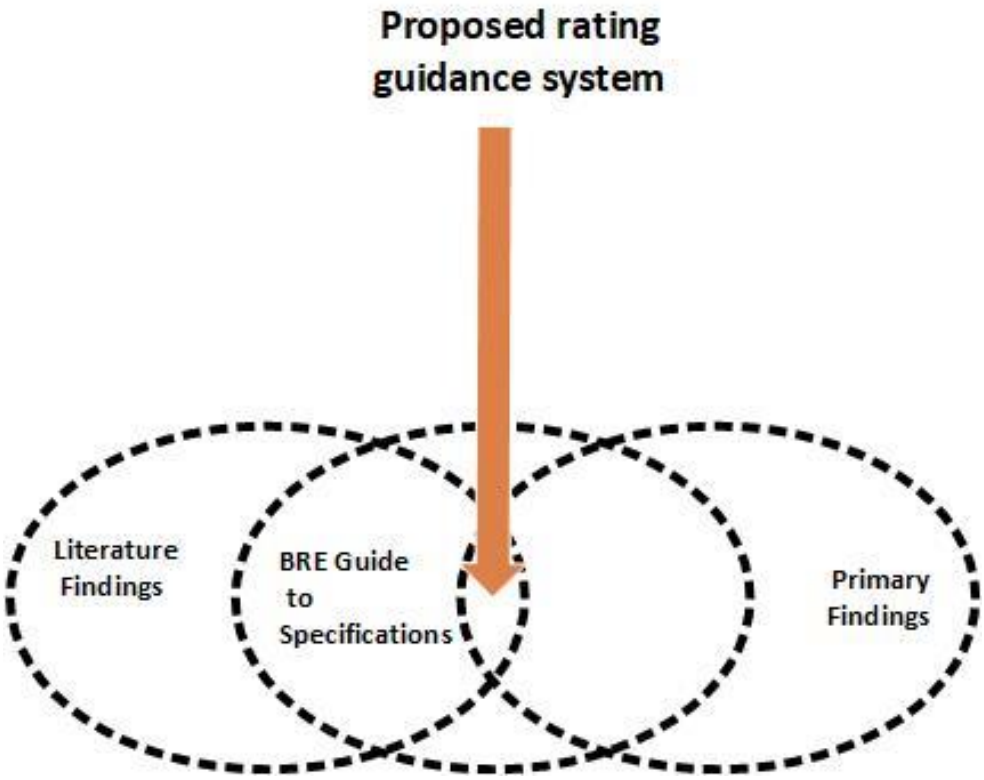


Figure 5-1 development of the proposed design guide. Source: author

In order to create the proposed design guide, the process was developed according to the process map presented in Figure 5-2. This process map allowed the researcher to take advantage of BRE environmental profiles and to implement the major findings from the literature and the primary findings in a logical order. The process map was divided into six stages, starting with a review of literature and then selecting BRE environmental profiles, before conducting primary data collection. In the fourth stage, there was an analysis of the literature and primary data, followed by the fifth stage which involved applying the findings and formalising the design guide to give it a practical form. The fifth stage constituted evaluating the design guide, as explained in the next section.

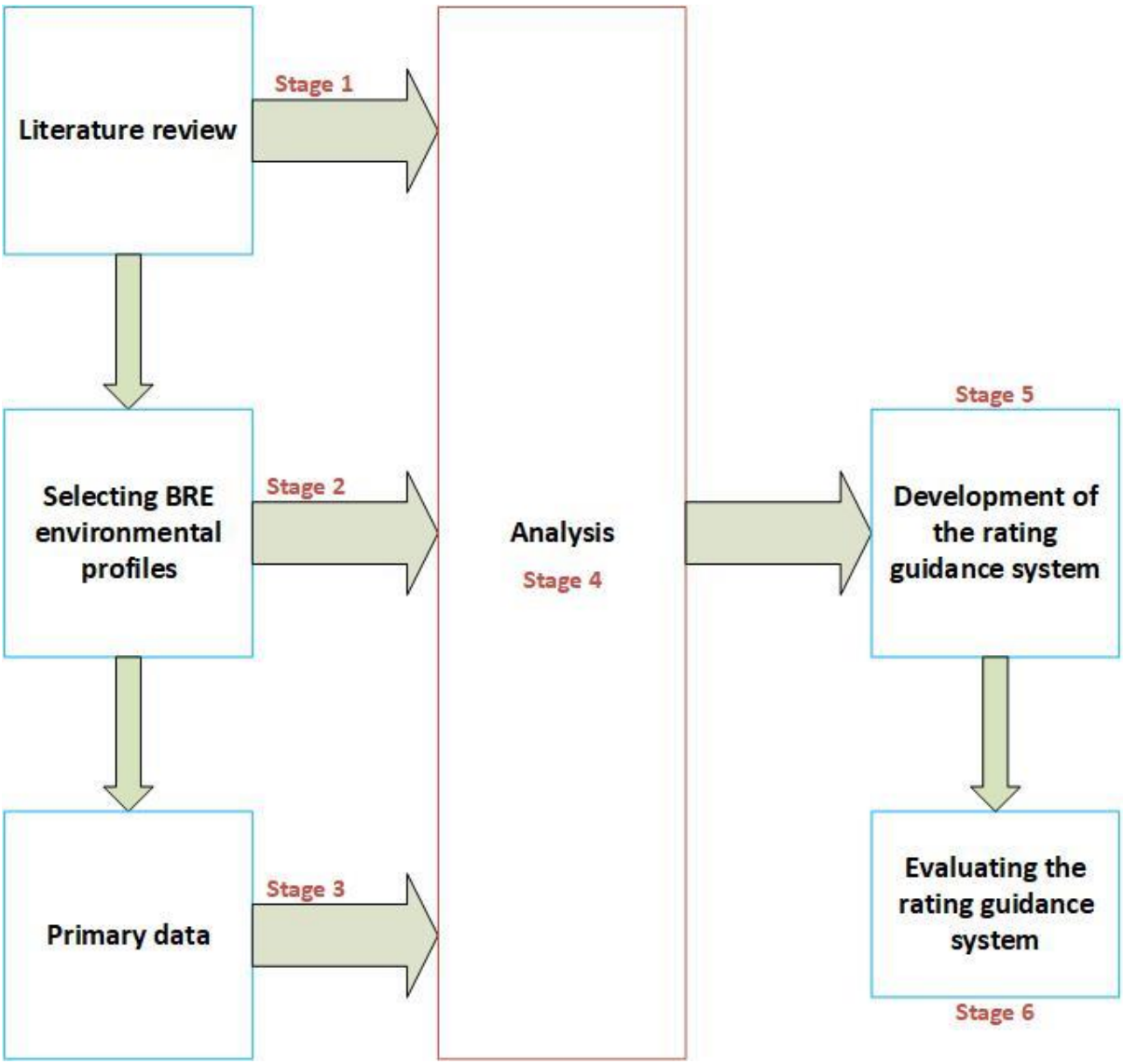


Figure 5-2 stages of developing the rating guidance system. Source: author

5.4.1.1 Stage 1: Literature review

From reviewing the literature related to the topic, the researcher discovered that there are no existing tools or guidelines that combine the objectivity of sustainability and the subjectivity of luxury. Additionally, previous studies showed that designers have problems implementing practice sustainable designs as they lack the knowledge to select and specify sustainable materials. The review of the literature helped the designer to find the suitable tool to use in assessing the environmental impact of material finishes, as explained in the next section.

5.4.1.2 Stage 2: Selecting an environmental assessment method

In order to develop a design guide to help designers selecting luxury sustainable material finishes for sustainable high-end hotel projects, the researcher selected BREEAM as a reference for this study. BREEAM is the world's leading sustainability assessment method for master planning projects, infrastructure and buildings, as discussed in detail the literature on BREEAM in Chapter 2.

BREEAM is used widely in the UK, where different building industries are trying to be environmentally friendly with help from BREEAM. While BREEAM assessing buildings, they do not assess any materials or products in isolation, therefore, the researcher used the green guide to specifications, the green guide ratings for floor finishes, and the environmental profile as a guide and a source to find a simple easy way to help designers select sustainable materials. The researcher then relied on the environmental profiles by BRE. The environmental profiles can be accessed through the Green Book Live website, or through any manufacturer awarded the environmental profiles, and this can make it easier and quicker for designers to specify sustainable materials. Additionally, using the environmental profile will save so much of designers' time, where they are not able to run an LCA for the material finishes if it consumes time and need a large amount of data (see section 5.3 and Chapter 2). Thus, using an existing rated sustainable material from a known organisation is easier and

more efficient. Moreover, this can make it easier to select a luxury carpet. BRE environmental profiles, the green guide to specifications and the BREEAM building assessment do not include any appearance category. Therefore, there was a need to develop a tool to help designers specify luxury material finishes. The development of a design guide to help designers select and specify luxury sustainable materials (using carpet as a case study) required the researcher to specify exactly what a luxury carpet is. Therefore, the researcher conducted primary and secondary research focusing on carpet materials to specify the main categories of a luxury carpet for a hotel guestroom.

5.4.1.3 Stage 3: Primary data

The primary data played an important role in developing the design guide. It was collected via a variety of methods like interviews with professionals (designers, hotel managers, manufacturers, BRE), questionnaires completed by luxury hotel guests and designers, a case study of a luxury hotel and the carpet test questionnaire. The data gathered from these different methods helped the designer to shape the design guide.

5.4.1.4 Stage 4: Analysis

As discussed in Chapter 2, the green guide to specifications, the green guide rating for flooring finishes, and the environmental profiles all rely on numerical values and comparisons. These numbers were translated into a simple rating system in the green guide to specifications and the green guide rating for flooring finishes; an A+ to E ranking system to make it easier for specifiers to understand. In the environmental profiles awarded to the different carpet manufacturers from BRE, this simple rating was given as an overall rating for the carpet material, as well as an overall eco-point. But this overall rating or overall eco-point does not indicate if the material has a low or high impact on health and well-being, where when the overall eco-points are low we might find the human toxicity high, and when the human toxicity is low the eco-points are high, as we can see in Figure 5-3. This did not include any subjective or descriptive

values, but the researcher is trying to combine between the existing numerical values in BRE environmental profiles and the subjective values from the secondary and primary research.

The green guide rating for flooring finishes covers only certain carpet materials: polypropylene cut, polypropylene loop tufted, 50/50 wool/polypropylene, polyamide cut and 80/20 wool/polyamide cut tufted. The 100% wool, 80/20 wool/silk, 100% natural silk and 100% artificial silk options are not covered.

The environmental profiles are based on a list of categories as mentioned in Chapter 2. The only category that we can look at to assess the impact on health and well-being is human toxicity, as we cannot consider the overall eco-point as it does not indicate the right value of human toxicity. Focusing on the human toxicity impact is important for the indoor environment, and deciding on choosing human toxicity is to leave some flexibility and space for designers to choose materials that may not be available in the UK, where high-end hoteliers usually focus on luxury. If they cannot not find luxury sustainable materials within the UK, they still have the opportunity to find them within the other materials awarded with environmental profiles from BRE outside the UK.

Characterised Data

Issue	Value	Unit
Climate Change	97.3	kg CO_2 eq. (100 yr.)
Water Extraction	0.815	m^3
Mineral Resource Extraction	0.0149	tonnes
Stratospheric Ozone Depletion	0.0000889	kg CFC11 eq.
Human Toxicity	24.6	kg 1,4-DB eq.
Ecotoxicity to Freshwater	0.889	kg 1,4-DB eq.
Nuclear Waste (higher level)	0.000000143	m^3 high level waste
Ecotoxicity to Land	0.18	kg 1,4-DB eq.
Waste Disposal	25.5	kg
Fossil Fuel Depletion	1540	MJ
Eutrophication	0.0474	kg PO_4 eq.
Photochemical Ozone Creation	0.0578	kg ethene eq.
Acidification	0.469	kg SO_2 eq.

Normalised data

Issue	Value	Western European Citizen's Annual Impacts
Climate Change	0.00791	12300 kg CO_2 eq. (100 yr.)
Water Extraction	0.00216	378 m^3
Mineral Resource Extraction	0.000611	24.4 tonnes
Stratospheric Ozone Depletion	0.000409	0.217 kg CFC11 eq.
Human Toxicity	0.00125	19700 kg 1,4-DB eq.
Ecotoxicity to Freshwater	0.000675	1320 kg 1,4-DB eq.
Nuclear Waste (higher level)	0.00603	2.37 x 10^{-5} m^3 high level waste
Ecotoxicity to Land	0.00146	123 kg 1,4-DB eq.
Waste Disposal	0.0068	3750 kg
Fossil Fuel Depletion	0.00566	273 GJ
Eutrophication	0.00146	32.5 kg PO_4 eq.
Photochemical Ozone Creation	0.00268	21.5 kg ethene eq.
Acidification	0.00659	71.2 kg SO_2 eq.

BRE Ecopoints score: 0.36 Ecopoints

Characterised Data

Issue	Value	Unit
Climate Change	76.1	kg CO_2 eq. (100 yr.)
Water Extraction	1.38	m^3
Mineral Resource Extraction	0.0444	tonnes
Stratospheric Ozone Depletion	0.0000831	kg CFC11 eq.
Human Toxicity	20.5	kg 1,4-DB eq.
Ecotoxicity to Freshwater	4.19	kg 1,4-DB eq.
Nuclear Waste (higher level)	0.000000134	m^3 high level waste
Ecotoxicity to Land	0.213	kg 1,4-DB eq.
Waste Disposal	49.8	kg
Fossil Fuel Depletion	1690	MJ
Eutrophication	0.0614	kg PO_4 eq.
Photochemical Ozone Creation	0.05	kg ethene eq.
Acidification	0.388	kg SO_2 eq.

Normalised data

Issue	Value	Western European Citizen's Annual Impacts
Climate Change	0.00619	12300 kg CO_2 eq. (100 yr.)
Water Extraction	0.00365	378 m^3
Mineral Resource Extraction	0.00182	24.4 tonnes
Stratospheric Ozone Depletion	0.000383	0.217 kg CFC11 eq.
Human Toxicity	0.00104	19700 kg 1,4-DB eq.
Ecotoxicity to Freshwater	0.00318	1320 kg 1,4-DB eq.
Nuclear Waste (higher level)	0.00566	2.37 x 10^{-5} m^3 high level waste
Ecotoxicity to Land	0.00173	123 kg 1,4-DB eq.
Waste Disposal	0.0133	3750 kg
Fossil Fuel Depletion	0.00619	273 GJ
Eutrophication	0.00189	32.5 kg PO_4 eq.
Photochemical Ozone Creation	0.00232	21.5 kg ethene eq.
Acidification	0.00545	71.2 kg SO_2 eq.

BRE Ecopoints score: 0.424 Ecopoints

Figure 5-3 example of an existing carpet environmental profiles. Source: BRE (2017)

Guidelines to specify luxury sustainable carpet materials need to specify elements and specifications that shape a luxury carpet. From the primary and secondary research (as mentioned in chapters 2 and 4), the luxury carpet for a hotel guestroom can be specified by the tangible and intangible aspects, which include the feel and the look. This was found from the analysis of data from the primary and secondary research. According to the primary data, there are three main elements to specify a luxury carpet: material type, thickness and pile style (see Figure 5-4).

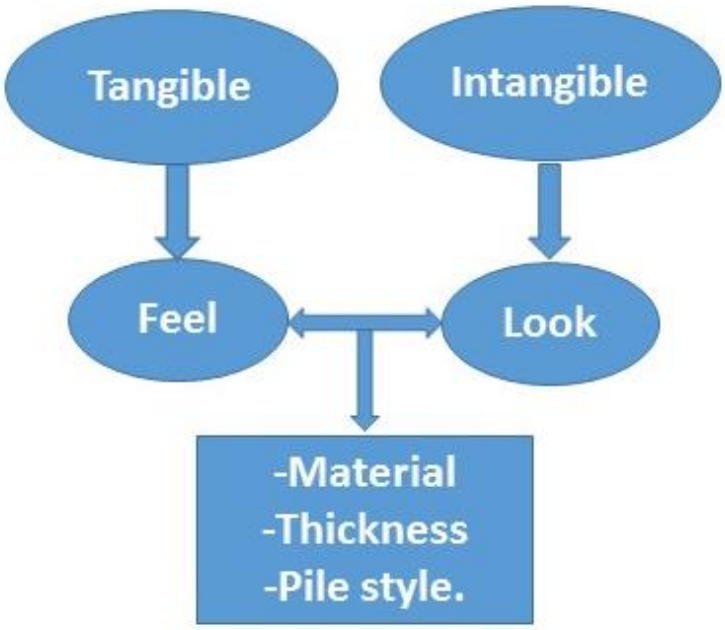


Figure 5-4 the specified categories to specify a luxury carpet. Source: author

From the primary and secondary data (mentioned in chapters 2 and 4), the specifications of the three elements of a luxury carpet are shown in Table 5-1.

Material type	- **100% art silk** - **100% silk** - **100% wool** - **80/20 wool/silk** - **80/20 wool/ nylon**
Thickness	**Minimum of 9 mm for art or natural silk carpet** **Minimum of 12 mm for 100% wool, 80/20 wool/silk, and 80/20 wool/nylon**
Pile style	**Woven (Axminster or Wilton)** **Tufted (Saxony or velvet textured)**

Table 5-13 Luxury carpet specifications. Source: author

As sustainability becomes part of design, interior designers need to look for more ways to specify sustainable materials to create a healthy indoor environment. Manufacturers and BRE should help them by creating LCAs for the material finishes to demonstrate their environmental impact. Therefore, combining the sustainability aspect with the luxury aspect was achieved through three phases. The first phase was undertaken by reading related studies, including those focusing on luxury material finishes and the most well-known assessment method used in the UK for material finishes. The next stage was conducting different methods to fill the gaps and achieve the research aim, which were represented by interviews with professionals, questionnaires for designers, questionnaires for hotel guests and a carpet test questionnaire for academics from an art and design background. Finally, by analysing all this data and developing the guidelines by combining the objective elements of sustainability with the subjective elements of luxury, we can specify the right luxury sustainable carpet (see Table 5-2).

Sustainability		Luxury		
BRE environmental profiles		Material type	Carpet total thickness	Pile style
Value of one or more of the 13 categories	Over all eco-points			
★	★	- Art silk (deluxe) ★ - Natural silk (deluxe) ★ - Wool - Wool and silk	- 9 mm minimum if its art silk or natural silk - 12 mm minimum if its wool or wool and silk	- Cut if its art silk or natural silk - Cut, woven, tufted or textured if its wool

				or wool and silk

Table 5-14 the combination between luxury and sustainability tools.

5.4.2 An overview of the stages of the design guide

As the designers explained in the interviews, the design process is in four stages: the brief stage, design concept, design development and design details. The suggested design guide for luxury sustainable carpet for high-end hotel guestrooms will be applicable in stages 2 and 3 of the design process. Where these two stages are important to set the concept, the used materials and source it as designers stated in the interviews in Chapter 4. As mentioned before in section 5.3 that quantitative eco-tools are with no use in the concept design where designers cannot run a LCA due to the large amount of data needed to do it as well as it consumes so much of time Allione et al. (2012). Therefore, the researcher adopting the BRE environmental profiles of carpets to combine it as a ready to use quantitative tool to find the environmental impact of a carpet with a qualitative tool to evaluate how luxury is the carpet. The four stages of the design guide leading to the outcome, which is the proposed luxury sustainable carpet for a high-end hotel guestroom that meets the standards of BREEAM and meeting the hotel owner of the luxury carpet. These stages are presented in the next section. Figure 5-3 shows the proposed design guide.

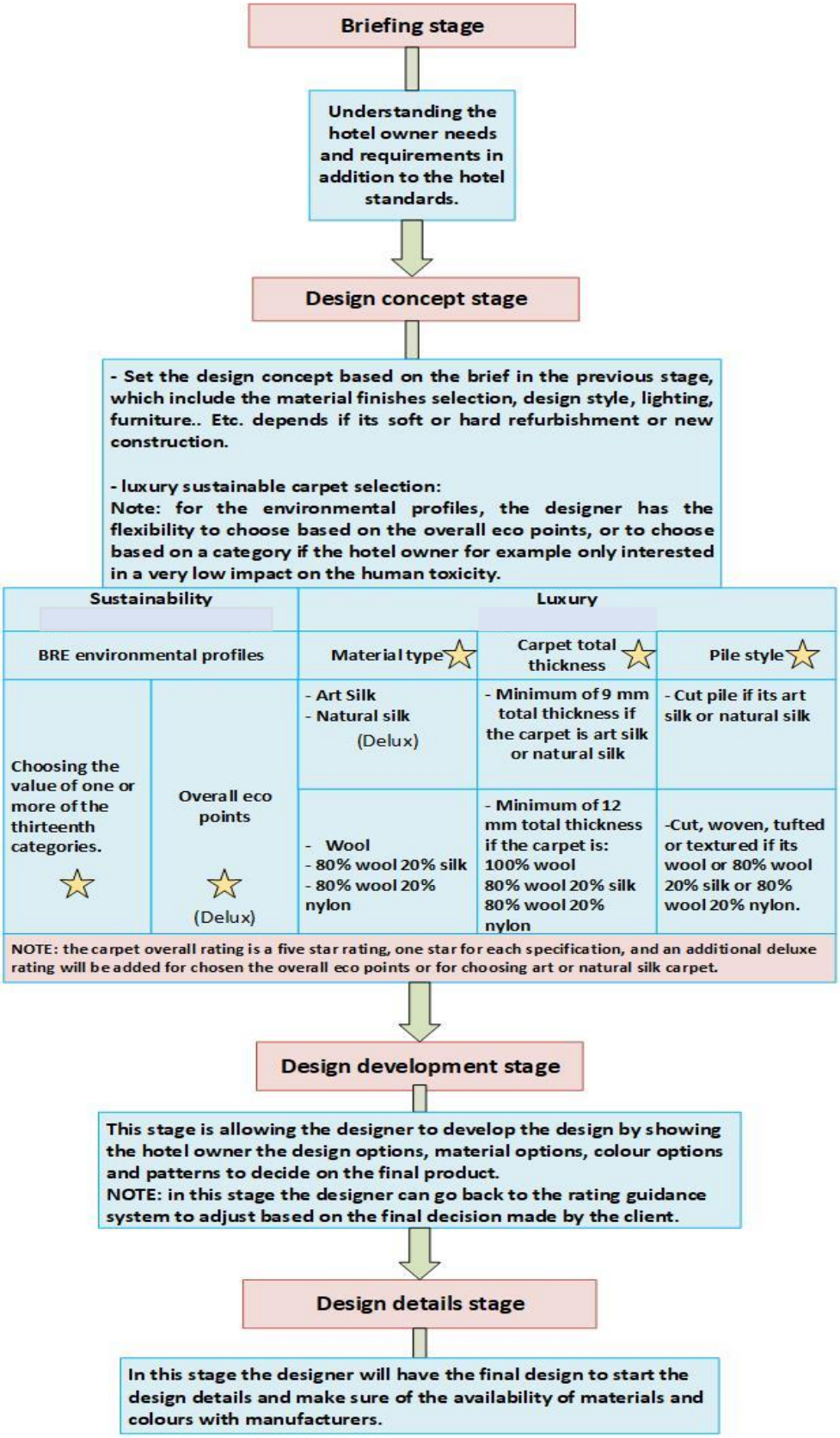
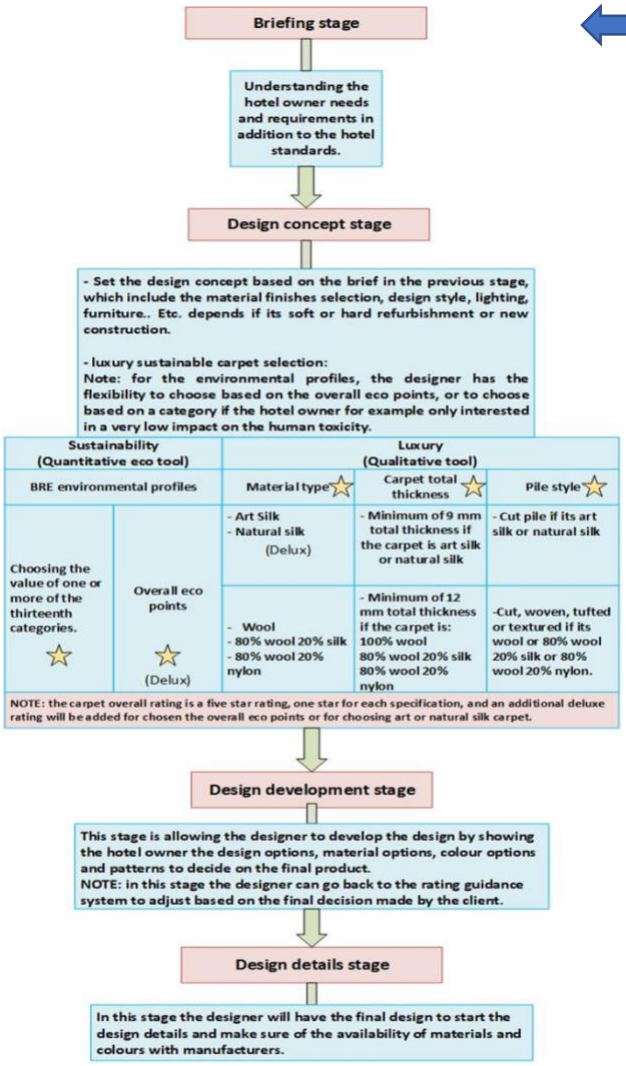


Figure 5-15 the proposed carpet design guide. Source: author

Luxury	Luxury hotel
Comfort	Spacious
Opulance	Comfortable
Exclusive	Glamorous materials
Unique	High quality finishes
Emotional pleasure	Described as a five-star hotel by AA hotel services
Beauty	Using crowns or stars to rate hotels quality by giving 5 crowns/stars to the luxury hotel

Sustainable carpets	Luxury carpets	Guidelines and eco-tools related to carpets
Zero or low VOCs materials	Superior materials like animal hair or silk	GUT
Carpet tiles	High thickness value	BREEAM and BRE environmental profiles
	Tufted carpet	

Table 16 summary tables linked to the proposed carpet design guide



This stage is important for designer to know the requirements and the hotel standards

In this stage, designer will be able to select the suitable carpet based on the requirements from the briefing stage

Designer can rate a carpet by using the five-star rating based on the two categories; sustainability and luxury. For instance, choosing a wool tufted carpet with a 12 mm thickness and a low overall eco point from BRE environmental profile will score a 4 star deluxe carpet

Designer can modify or change the carpet in the design development stage and provide the final option in the design details stage

Figure 5 How a designer can use the proposed carpet design guide

5.4.2.1 Briefing stage

The briefing stage is the basis for the selection of the luxury sustainable carpet, as with any material selection for any project, where the designers will understand the needs and requirements of the client. The goal of this stage is to understand the sustainability aspects that the hotel owner is looking for. For example, some hotel owners look for recycled or low-emission materials. This will help the designer when specifying the carpet material alongside the given standards for the hotel carpet like colours, thickness or material. This stage can involve interviews or questionnaires with the hotel owner(s), a questionnaire with loyal guests and interviews or questionnaires conducted with employees to understand their needs.

5.4.2.2 Design concept stage

This stage is the most important to specify material finishes. The specifications should be informed by the needs and requirements of the hotel owner gained in Stage 1. For high-end hotels the quality and guest experience is important (as mentioned in Chapter 4). Therefore, using an eco-tool to specify sustainable material finishes is not enough. Hence, as there are no tools to specify luxury materials, the researcher suggests a luxury tool combined with the sustainability which designers can use in the design concept stage. This section will explain how to use the combined eco-luxury tool.

As mentioned above, after defining the requirements of the hotel owner (especially in terms of sustainability aspects and the specifications that their hotel accepts), the designer then needs to meet these requirements in one carpet. The eco-luxury tool rating is a five-star rating which is easy to understand for designers, hotel owners and manufacturers. By achieving a five-star rating, you achieve a perfect luxury sustainable material; with two for sustainability and three for luxury. The sustainability stars are

divided as follows: one star for using low overall eco-points awarded with an A+ green guide rating, and another star if using one or more of the 13 categories with a low value number. Additionally, using A+ carpet in terms of the green guide rating's overall eco-points will add a deluxe rating beside the star.

The designer will specify these overall eco-points and values from the environmental profiles which can be found on the Green Book Live website. The existing environmental profiles can be found by clicking on the 'schemes' tool to find the environmental profile page with the option to specify the category: floor finishes, external wall, insulations etc., and also the designer can write down the company name if its known. After that, the designer can write down the product name. And one important option that they provide is the country, as BRE is famous around the world and present in many countries, BRE also run environmental profiles for materials and products outside the UK, which is excellent for hotel owners and designers especially if they could not find the preferred material finishes within the UK.

Designers' next stage will be looking at the filtered carpet manufacturers that meet their client's requirements, and look at their overall eco-point, decide on a number of options based on the sustainability requirements from their client, and then based on the names of these manufacturers the designer can visit their websites and look at the specific carpet awarded with the environmental profile and look at the appearance specifications like the material, thickness, and pile style, as all manufacturers should provide this information on their websites. The designer starts to compare these specifications with the luxury specification in the eco-luxury tool; the material, thickness and pile style. If the carpet meets one or more of these specifications, then the designer can order a sample with the colour options he was given by the client. If the manufacture does not provide the material type, thickness and pile style then the designer can still order a sample and compare it with eco-luxury tool specifications in Figure 5-7.

The researcher decided to give the choice of As most of the respondents chose the art or natural silk carpet as the most luxurious carpet for a high-end hotel guest room, the

researcher decided to add ‘deluxe’ to the star rating for the proposed design guide when choosing natural or art silk carpet. This option may not be as sustainable as the wool carpet or the mix of wool and nylon but it is the most luxurious carpet option. The silk carpets or the mix of silk and wool might be used by luxury hotels in their suites to express a higher level of comfort than the standard rooms, as found from the case study in Chapter 4. Additionally, it was found that the mix of 80% of wool and 20% of nylon gave the carpet greater longevity and was easier to clean.

All the filtered samples which meet the eco-luxury tool specifications can be ordered from the manufacturers’ websites to be discussed with the client in the next stage.

5.4.2.3 Design development stage

In this stage, the designer will present the design concept to the hotel owner in drawings and samples to crystalize the design concept, including the design style, colour, cost and materials. This stage is crucial to help both designers and the hotel owner decide on the final carpet in terms of sustainability, luxury and cost. This depends on the hotel owner’s priorities; one of these aspects will win. This means that the carpet sample will encompass the three aspects, but might be more luxurious than sustainable or the opposite; it might get two stars in terms of luxury and one in terms of sustainability, or vice versa. Designers can also play an important role in convincing the hotel owner of the best material to choose. Finalising and approving the design concept stage will lead the designer to the next stage. Carpet samples are important in this and the previous stage, as they will allow both designers and hotel owners to evaluate the tangible and intangible aspects of luxury by looking at and touching the samples. This can indicate how luxurious a sample is based on the specifications in Figure 5-8.

5.4.2.4 Design details stage

This stage will take the final decisions in completing the design and preparing the final measurements, drawings, materials and colours. In this stage and after the design development stage (where the designer seeks approval for the design concept and receives the approved carpet options from the hotel owner), the designer checks with the manufacturer about the availability of the number, measurements and colour of the approved carpet, places an order and customises it if necessary.

5.4.3 Initial Evaluation of the design guide

The design guide was initially evaluated by three designers and one BREEAM sustainability director, as the researcher could not recruit more designers to evaluate the design guide after they failed to reply to an email request to evaluate the design guide. Additionally, the researcher was working within a limited timeframe.

The evaluation was carried out by sending the four respondents the design guide in Figure 5-8 by email, and asking them to follow the procedure of finding a carpet sample through the Green Book Live website and to evaluate if combining both the objectivity of sustainability and the subjectivity of luxury made sense for them, and if that would help them with their selection of a luxury sustainable carpet for a high-end hotel guestroom.

The responses were promising, where the BREEAM member showed an interest in the combination between the environmental profiles with the subjectivity of luxury, and thought this could help to develop easier and attractive sustainable material specifications that combine both sustainability and appearance specifications to attract hotel owners and encourage them to embrace sustainability.

The designers expressed a satisfaction with the design guide, explaining that this eco-luxury tool can save them a lot of time searching randomly on the internet for sustainable carpet suppliers. One of the designers thought that a design guide would be perfect if it could be developed to cover all material finishes. Moreover, he suggested to add more carpet materials to the luxury specifications tool, explaining

that designers often use more synthetic carpet materials in their projects than were represented, and that including such carpets would help them.

5.5 Chapter summary

This chapter presented the rationale for the proposed design guide for a luxury sustainable carpet for high-end hotel guestrooms, which was first conceived as a result of the research gap observed from literature review. It discussed an overview of the guidelines with an emphasis on what constitutes a guideline and the main aims of using guidelines, both qualitative and quantitative. The researcher is of the opinion that combining both qualitative and quantitative factors in a design guide suits the dual goal of satisfying the objectivity of sustainability and the subjectivity of luxury.

In addition, this chapter demonstrated the practical stages of the proposed design guide to specify a luxury sustainable material for high-end hotel guestrooms. The selection process involved the briefing stage, the design concept stage, design development stage and design details stage. The main focus of the eco-luxury tool was in the design concept and design development stages, but applying the eco-luxury tool would not be useful without the brief stage, which aids understanding of the needs and requirements of the hotel owner. It cannot be finalised without the design details stage, where the designer need to check the availability of the final eco-luxury carpet option.

The design guide initial evaluation results showed satisfaction from the respondents, who expressed that this would save them time spent searching for an eco-luxury carpet. They showed interest in a full luxury sustainable material finishes design guide.

CHAPTER 6

Chapter 6: Discussion and conclusion

6.1 Introduction

This is the final chapter of this project, and it presents the research discussion, conclusion, limitations, contribution to knowledge and recommendations. Based on the data presented from chapters 2 and 4 and connecting the findings from the data in the literature review and those from the primary research, this chapter presents a discussion on the findings towards the development of the guidelines and rating system to help designers, hoteliers and manufacturers in the selection of luxury sustainable material finishes for luxury hotels in the UK. This chapter presents an in-depth understanding of the findings to address the research aim.

6.2 Research discussion

In relation to the literature review and the research aim and objectives, this section discusses the primary and secondary data discussed below under the following subheadings:

- Luxury material finishes in the hotel guestroom.
- Interest of hoteliers, guests and designers in sustainable hotel material finishes.
- Challenges designing luxury sustainable hotel.
- Luxury hotel and sustainable certification schemes.
- Assessment method and materials rating.
- Luxury hotels sustainable practices.
- Need for design guide in selecting luxury sustainable material finishes

6.2.1 Luxury material finishes in the hotel guestroom

As mentioned in the literature review in Chapter 2, it was revealed that there is no basic definition for luxury (Barnier et al., 2012; Hennigs et al., 2015; Yang and Mattila, 2016). The main reason for this, as Yang and Mattila (2016) describe, is that luxury arises from its subjective character. Similarly, Kapfere (2014) and Hennigs et al. (2015) highlight the subjective character of luxury: that it depends on individuals needs and experiences, and that it refers to indulgence objects, the concept of being unique, and goes further than people's needs in life. On the other hand, Barnier et al. (2012) state that luxury products or experiences satisfy both psychological and functional needs. Line and Hanks (2015) argue that luxury has two aspects – tangible and intangible – which hold three values that make consumers consume luxury products: hedonic value where the product arouses pleasure and delight in the user, symbolic value where the consumer treasures the psychological aspect of a product to express or symbolise a status (this is mostly found with tangible products), and the financial value where consumers consume luxury products for high prices to signify their wealth. Additionally, some consumers correlate expensive products with superiority.

Unfortunately, little research has been conducted on luxury hotels or luxury hotel interior design materials, and as such, the perceptions that are derived are mainly drawn from marketing, management and philosophy literature. Kunz (2003) defined luxury hotels as the most comfortable accommodation, which suggest a certain element of dreaming. On the other hand, Ahn and Pearce (2013) describe a luxury hotel as spacious, including glamorous materials, with premium lighting that provide a pleasant and inviting atmosphere, and toilets with a big tub and multiple showerheads, a hotel or property that is dedicated to comfort, service, space and history – and this typically means high expenses. To ensure maximum return on investment, such hotels require good management. According to the AA Hotel Services, in their hotel quality standards, the word luxury is used to describe 'five star' hotels (AA, 2011).

Kapferer (2010) states that luxury is criticised for the focus on certain products and consumers, the waste of resources, and luxury brands being very slow in following the

sustainability trend. However, in his analysis, Kapferer discovered that luxury and sustainability both focus on rarity and beauty, as will be explained in detail in section 2.2.2

Kunz (2003) states that according to international standards, a luxury hotel is an enterprise that would be ranked the highest in hotel ratings. Luxury hotels are intended to provide their guests with some sort of unique experience, which can either be derived from its exclusive geographical location or its outstanding design. A luxury hotel would be more appealing if it combines both of these aspects. To select the most suitable architectural design, hotel designers need to look beyond the domestic and functional aspects of design. This way the design will be able to provide guests with a feeling of adventure as well as providing excellent services and comfort (Kunz, 2003).

The researcher believes that luxury can be defined as “the most comfortable”, agreeing with Kunz (2003), while luxury material finishes for a high-end hotel guestroom can be defined as “the best materials, which makes the occupants feel extra comfortable while looking opulent at the same time”. The researcher’s interviews with 14 professionals (designers, manufacturers, hotel managers, BREEAM) confirms the subjectivity of luxury, where 50% of respondents relates luxury with the social perspective, explaining that the luxury material finishes of a high-end hotel guestroom would be about the feel, touch and visual elements, which highlights the importance of the intangible aspect of luxury. Hence, luxury can be subjective if we generalise it, but when the researcher asked designers to define a luxury carpet for a high-end hotel guestroom, the answers were clear, and they were able to define it based on their experience in designing high-end hotels. Additionally, the researcher’s carpet test questionnaire confirmed the importance of the look, touch and feel to specify a carpet, where most respondents started to touch the artificial and natural silk carpets by identifying how smooth are they just by looking at them. Therefore, the researcher was able to produce a definition of a luxury carpet for a high-end hotel. This means that luxury can be subjective when it is generalised, but it is definable if we limited it to a product or a material. The researcher believes that luxury can be rated based on each product. For instance, the preferred carpets from the carpet test

questionnaire were the most comfortable-feeling ones, especially the silk carpet, both artificial and natural, which provides a more comfortable feeling than the wool one.

6.2.2 Luxury carpet for high-end hotel guestroom

It was mentioned in Chapter 2 that carpet is a useful flooring material for its acoustic, thermal and aesthetic characteristics (Godsey, 2017). In the UK, carpets are used widely in non-domestic buildings for their noise reduction and overall comfort for users (Dutfield et al., 2011). Additionally, ‘‘around 400,000 tonnes of carpets are sent to landfill in the UK annually’’ (Sotayo et al. 2015, p. 97), which is becoming unreasonable due to the increase of landfill costs and reduced availability (Sotayo et al., 2015). Luxury carpet was described in Chapter 2 as a carpet made of a noble material like animal hair or silk, which are usually handmade. Also, luxury carpet can be customised by producing it from high quality materials, and producing them in tiles so the customer can build different designs and create an exclusive interior design by combining carpet tiles. (Gardetti & Muthu, 2015). Gardetti and Muthu (2015) added that luxury carpet made of animal hair or silk is not accommodated by the recycling process due to its relatively small quantity. Godsey (2017) states that the most luxurious raw carpet material is silk. Silk is related to wealth and luxury, as it has been named as “the queen of fibre” (Gardetti & Muthu, 2015). Additionally, the researcher found out that the weight of the carpet is not related to the luxury as this was classified by the European standard. Where some of the nylon carpet tiles are heavier in weight than silk or wool carpets but the respondents were not tend to describe these carpets as luxury although it is heavier than the silk or wool carpet.

The interviews with professionals revealed their opinions of what is a luxury carpet for a high-end hotel guestroom, which confirmed previous studies on the definition of a luxury carpet. Professionals emphasised that a luxury carpet is made of a quality material like a mix of wool and silk, 100% wool or 100% silk with a thickness of 12 mm. The carpet test questionnaire with academics with an art and design background confirmed the specifications of a luxury carpet for a high-end hotel guestroom, and the

result showed that luxury carpets are usually artificial or natural silk, wool or wool and silk, with a minimum thickness of 9mm for silk and 12 mm for wool or a mixture of wool and silk.

6.2.3 Interest of hoteliers, guests and designers in sustainable hotels

Earlier in this research, it was revealed that the hotel industry only lately started adopting sustainability. This was not in terms of their hotel building design strategies or materials, but was a way of using sustainability to save on running costs, where they started by saving water by asking the guests to use the same towels for more than a day and installing sub-metering systems (WINCHIP, 2007). Ahn and Pearce (2013) noted that hoteliers are interested in sustainability for its financial savings and to please their ethics. Agreeing with this, the researcher discovered from interviews with hotel owners that luxury hotels are still not up to date, and that they started following sustainability, but only in terms of their operational procedures. However, hotel owners who started following sustainability in terms of building strategies are focusing more on strategies which can save them money, like installing LED bulbs or recycling water.

Some luxury hotel owners claimed that they cannot follow building sustainable strategies because their hotel building is very old and that they cannot do anything to the construction itself. This indicates the lack of information hotel owners have about sustainability and how they can make their buildings and interiors sustainable, where they currently focus more on having a luxury interiors.

There is a noticeable interest of hotel guests and holidaymakers expecting their hotel to be environmentally and socially responsible while also expecting high levels of comfort and luxury (Richardson, 2016). This was confirmed in the researcher's guest questionnaire, where guests are interested in staying in a luxury sustainable hotel if they had the choice between a luxury hotel and a luxury sustainable one, but were more interested in the luxury element, as most of the luxury hotel guest questionnaire respondents expressed their disagreement with not changing the bedding for more

than a day. We can understand from this that people are interested in sustainable hotels, but only without compromising the luxury element.

Previous studies showed that designers are interested in low-impact interiors to create productive and healthy places to work and stay (Benson, 2013). But they did not reflect this in their design choices where they had a lack of knowledge regarding sustainable issues. Also designers do not tend to select sustainable materials unless they are required by the client (Máté, 2006). Moreover, Jones (2008) states that the resources available to interior designers do not support their role in creating a sustainable design where the available materials information is more focused on the construction materials rather than interior finishes. Interior designers, as Yang et al. (2011) state, ignore energy savings and emissions reductions. This was confirmed from the researcher's interviews with designers, as two designers expressed their lack of knowledge regarding sustainable materials and their resources and their choices are usually limited, with few options like timber and recycled plastic, which was also confirmed in the researcher's questionnaire with designers.

Interviews with designers confirmed the problem with selecting sustainable materials and practising sustainable designs, as interviews showed that they find it hard to specify sustainable material finishes where there is little information, and it is hard to be sure of a sustainable material from manufacturers where there is so many suppliers calling their materials sustainable. Furthermore, BREEAM does not cover the appearance aspect of material. Also, the environmental profiles by BRE focus more on construction rather than finishing materials.

6.2.4 Challenges designing luxury sustainable hotels

It has been revealed in previous studies in this research that there is always a conflict between the comfort and satisfaction of hotel guests and green building practices (Ahn & Pearce, 2013). Kasim (2004) argued that if the target achieved in balancing between extraordinary client experience and a sustainable hotel then this would open new opportunities for business endeavours. Ahn and Pearce (2013) focused in their study

on developing a better understanding of how to achieve the aim of sustainability in a hotel while keeping up a luxury environment for the guests' satisfaction in terms of the construction materials as well as the electricity and water consumption, this was not focusing on interior materials. According to Kirk (1995), the lack of comfort in sustainable hotels is a consequences of conservation of energy and water, which could draw away the guests' extraordinary experience and comfort from a guest's experience and comfort. Kang and Guerin (2009) revealed that although interior designers interests in sustainable design but their actions in applying sustainable finishes for the interior environment are less frequent, adding that interior designers were not acknowledge of environmental problems associated to the full life cycle of interior finishes.

Researcher's interviews with designers confirmed hotel owners' main issue, as designers expressed that the cost is one of the main challenges designing a luxury sustainable hotel, in addition to the availability of sustainable materials. Designers explain that selecting sustainable materials is time consuming to search for sustainable material and trying to find the right sustainable material for their project, as many hospitality specialists lack a good knowledge of how luxury and sustainability might adapt together in the built environment, and how the sustainable decisions they take effect the indoor environment and subsequently the hotel guests. Sustainable design is usually presumed not to be attractive and to be uncomfortable (Mclennan, 2004). Additionally, designers find it hard to be 100% sure if the material is a real sustainable one, where there is a lack of information's about sustainable materials.

6.2.5 Luxury hotels and sustainable certifications

Interviews with hotel managers revealed that luxury hotels are usually more interested in sustainable tourism certificates, or sustainable management certificates. Luxury hotel owners find it hard to get a sustainable certification in the UK expressing that getting a certification in this country is quite difficult for them, but they hold tourism certificates like the green tourism certificate and the considerate hotelier award.

Getting certifications from famous schemes like BREEAM is considered as expensive for hotel owners as well as BREEAM is mostly focusing on the construction aspect with standards for schools, hospitals and offices and a very little focus of the hospitality industry. Additionally, Hotel managers lack of knowledge of green building certifications and how they can help in proving their building environmental impact, where they think that an old building is not applicable for improvements in terms of its environmental impact as well as the impact on its occupants.

6.2.6 Assessment methods and eco-tools

As discussed in Chapter 2 in this research, BREEAM is the most known assessment method and is widely used in the UK and around the world. Therefore, BREEAM was the focus of this research. When it come to the hospitality industry, the researcher found out that BREEAM is not covering this industry within their green guide to specifications and their interior material finishes rating, where they focus more on educational, hospital and office buildings. The literature revealed that BREEAM did not cover the appearance aspect of materials, and only took into account the environmental impact.

The use of assessment methods and material ratings is important for designers and specifiers, where specifying these materials by designers is hard, where it consumes time and designers do not have the knowledge to specify materials for the need of different numbers to run an LCA which needs software and sometimes specific machines to test the materials in certain circumstances. Therefore, assessment methods are really important and helpful if they cover the interior material finishes. Materials environmental profiles provided by BRE should be taken into consideration when specifying materials along with other factors like appearance, durability, cost, buildability, availability, function and operational and development control issues (Anderson et al., 2009).

The review of literature revealed that there are two types of eco-tools: qualitative and quantitative. Quantitative eco-tools are not beneficial throughout the concept and

product design where designers are directly involved, due to the large amount of data needed to run an LCA, which is not available in the concept stage; additionally, LCA is a time-consuming process. On the contrary, the qualitative eco-tools such as guidelines are able to guide designers and lead them through the concept and product design steps, enabling designers to make the right environmental decisions (Allione et al., 2012). The existence of qualitative guidelines which focus on material selection focused on three categories: materials with low environmental impact, extension of the material end-of-life phase, and the ethics and policies of the material manufacturer (Allione et al., 2012). There was no guideline focused on the appearance of the material beside the one developed by Allione et al. (2012), but in the researcher's opinion, Allione et al (2012) only described the material without giving any specifications for different building types.

6.2.7 Hotel sustainable practices

It was revealed from the literature review that hotels' sustainable practices are still improving, with hospitality sector adopting luxury sustainable hotels as a fashion. Many hospitality specialists lack a good perspective of how luxury and sustainability are combined together in the indoor environment, and how sustainable decisions they take affect the indoor environment and subsequently the hotel guests. Sustainable design is usually presumed not to be attractive and to be uncomfortable (Mclennan, 2004). Unfortunately, hotel owners tend to follow sustainability in terms of their operational procedures, focusing on eliminating the use of towels and declining to offer room service. Additionally, some hotels followed sustainability by focusing on having local food, using electric cars and recycling water.

Hotel owners only think to be sustainable in a way that saves them money, but these practices are affecting the luxury element for some guests. Interviews with hotel managers confirmed that they are following sustainability only to reduce costs by developing a points system which can add points to their guests if they decline room service system for three days.

6.2.8 Need for design guide in selecting luxury sustainable material finishes.

It was revealed in Chapter 2 that there is a large group of professionals (architects, specifiers, managers) who complain of the absence of rich, complete, accesible data in the area of selecting sustainable building materials for interior design (Godsey, 2017). Also, interior designers expressed how important and valuable sustainability and design are, but their actions in making choices often shows an opposite attitude, as many designers relied on their clients to insist on a sustainable design rather than lead or inspire their clients to adopt one, where others rated the importance of environmental concerns when making material selections as 'low' except the client precisely asked them to select materials for sustainable properties. This was due to the absence of confidence in their own understanding and the information about sustainable issues provided by suppliers was also a major burden (Máté, 2006). Kang and Guerin (2009) acknowledge that sustainable interior finishes were less frequently used to elements of environmentally sustainable interior design. It also appeared that interior designers were not aware of environmental issues related to the entire life cycle of materials.

The research agreed with Máté (2006) and Kang and Guerin (2009), where designers interviewed in this research showed an interest in a guideline or rating system to help them specify luxury sustainable materials.

Therefore, the researcher developed a guideline/rating system to help designers select luxury sustainable material finishes (using carpet as a case study), by combining

sustainability and luxury elements which will encourage designers to specify sustainable materials within their designs for the high-end hotel industry.

- **In Conclusion**

This research aimed to propose a design guide to help designers select luxury sustainable material finishes, which will help luxury hotels to start adopting sustainability in terms of their interior design. This aim is believed to be achieved.

The researcher found that we can define luxury material finishes by saying they are the most comfortable and opulent materials. But each luxury material finish should be defined by bespoke specifications, for instance, the specifications that the researcher developed to specify a luxury carpet cannot be used to specify a luxury wallpaper or item of furniture. Therefore, each interior material finish sector should be studied and defined.

The luxury hotel industry is slow in taking up sustainable practices due to many factors: the lack of information about sustainability, the belief that sustainable materials are not luxury, the role of designers in encouraging hotel owners to follow sustainability when the designers themselves are not informed enough and do not have time to look for sustainable materials and specify them. Additionally, the high cost of getting certifications from BREEAM as well as BREEAM's focus on other building industries, and its lack of data about material finishes, all create further issues.

6.3 Research conclusion

This section concludes this study by presenting outcomes in relation to the research aims and objectives and the summary of chapters and findings.

The main aim of this research was to propose a design guide of luxury sustainable material finishes for high-end hotel guestrooms, using carpet as a case study. The aim was supported with the following objectives:

1- To investigate sustainable development within the interior design of the luxury hotel industry in London.
2- To establish a basic definition of luxury material finishes for five-star luxury hotel guestrooms, from both primary and secondary research data.
3- To determine from designers and hotel owners the specifications of a luxury carpet material for high-end hotel guestrooms.
4- To investigate the challenges faced by designers when designing a luxury sustainable hotel.
5- To produce a tool for specifying luxury materials and finishes (using carpets as a case study) and combine this with an existing eco-tool to help designers in selecting luxury sustainable materials and finishes in the design concept stage.

The research aims and objectives were set to solve the research problems and questions. These emerged as a result of gaps in the literature and helped maintain focus on gathered data. The research questions are stated below:

14- What is a luxury material and/or finish for a high-end hotel guestroom?
15- Do guests of high-end, luxury hotels have an interest in sustainable luxury?
16- What stops hotel owners incorporating sustainable interior material finishes within their luxury hotels?
17- What stops designers using sustainable material finishes in their interior design projects?

Is it possible to combine luxury and sustainable material finishes?

6.3.1 Outcomes in relation to research aim and objectives

Five specific objectives were outlined for this research in Chapter 1 and are mentioned above in section 6.3. This section presents a summary of the extent to which these objectives have been achieved.

The main aim of this research is to explore the extent to which luxury and sustainability can co-exist in the design of high-end hotel guest rooms using carpet as a case study.

The key research objectives are:

1. The first objective was to review the hospitality and design literatures and establish the relationship between luxury and sustainability. The research has collected and evaluated the literature concerning both luxury and sustainability within the high-end hotel industry and the interior design profession focusing on material finishes, specifically on carpet for the guestroom. The literature review was divided into two main sections – luxury and sustainability – where the nature of both topics required the researcher to

investigate each topic alone and then discuss it within the context of the high-end hotel industry, where the subjectivity of luxury and the objectivity of sustainability required the researcher to adopt the mixed-methods approach to answer the research questions. Sustainability in the high-end hotel industry has been followed only recently, where the main target of this adoption is reducing costs. The literature revealed that hotel owners focused on sustainability in ways that can help them reduce monthly or yearly running costs, like using LED lightbulbs or asking the gusts to decline room service. This approach was not highly appreciated by most luxury hotel guests, who confirmed that this affected the quality of the hotel.

2. The second research objective was to identify the main design attributes for materials in luxury hotels. To achieve this objective, it was necessary to seek the views of designers, hotel managers and hotel guests in the study area. Despite the subjectivity of luxury, the researcher was able to identify a basic common definition of luxury material finishes for high-end hotel guestrooms as a natural material with high quality and refinement in detail, which enhances the feeling of the hotel guest by providing comfort and promoting health and well-being. Respondents also agreed it should help to provide a good night's sleep, and be expensive.

3. The third objective of this research centred on undertaking a mixed methods study of design decisions relating to carpets in luxury hotels leading to the definition of a luxury carpet for high-end hotel guestrooms that can inform designers. This definition and related specifications were developed from secondary data as well as from the views of professionals and the analysis of the case study. This primary and secondary data was incorporated into a carpet test questionnaire which confirmed the specification of a luxury carpet for high-end hotelsas one that was made of artificial or natural silk, wool or a

wool and silk mix with a minimum thickness of 9 mm for silk and 12 mm for wool or wool and silk carpets. Preference was also for a wall-to-wall tufted carpet.

4. The fourth research objective was crucial to understand the challenges facing designers when designing a high-end hotel. By undertaking a case study of a luxury hotel in London, reviewing the literature and collecting the designers' views of challenges facing them, it was uncovered that a lack of knowledge about sustainable material finishes made it hard for designers to make choices about them. Interior designers were not aware of the environmental issues related to the full life cycle of interior finishes, and the absence of rich, complete and accessible data presented additional challenges.

5. The fifth objective was to generate a design guide for decisions relating to carpeting in luxury hotels. The luxury-eco-tool, design guide, was presented in Chapter 5 and consists of four stages: brief, design concept, design development and design details. The central aim of the design guide is to encourage designers to select luxury sustainable material finishes at the concept stage.

6.3.2 Summary of chapters and findings

An overview of the entire research was presented in Chapter 1, the research background and research problems, followed by addressing the aim, objectives and research questions, the adopted research methodology and the research structure.

Chapter 2 highlighted the related research topics and the main problems which informed the direction of the research. The chapter addressed the history and definition of luxury in relation to the hotel industry, revealing the lack of interior design studies focusing on this topic. Then the chapter introduced sustainability in relation to the hotel industry and the relationship between luxury and sustainability within hotel buildings, specifically the material finishes of guestrooms, focusing on the carpet as a case study. This chapter also highlighted the environmental assessment tools, focusing on BREEAM as the most used assessment tool to assess buildings in the UK and focusing on the environmental profiles produced by BRE for materials and products inside and outside UK. Additionally, this chapter investigated the eco-tools and guidelines and their types and usage.

After reviewing the literature and revealing gaps and missing information in relation to the topic, this helped to frame and articulate the research methodology in Chapter 3, which presented the original research methodology and its role in forming the research methods, research philosophies, research paradigm and the research methodology with an explanation of selected and rejected methods and the data collection adopted in this study.

Chapter 4 presented the research primary data analysis and findings; case study, interviews, questionnaires and the carpet test questionnaire. Visual inspection was used to analyse the case study; content and statistical analysis were used to analyse the interviews, questionnaires and the carpet test questionnaire.

The findings of the primary data in Chapter 4 and from the literature review in Chapter 2 were all put together to propose the design guide in Chapter 5, which presented the

rationale of the development of a design guide followed by an overview of guidelines and then the development of the system based on both primary and secondary data. This was followed by presenting the design guide stages and then the initial evaluation.

Chapter 6 illustrated the research discussion focusing on answering the research problem from the primary data with a consideration of points of views put forward in the literature in Chapter 2. Moreover, Chapter 6 summarises the research findings in relation with the research aim and objectives, contribution to knowledge, recommendations, research limitations and potential future work.

6.4 Contribution to knowledge

- Creating luxury sustainable interiors is a great target since sustainability is an important trend. If we look at Ahn and Pearce's (2003) study we can see that they only tackled the luxury sustainable hotel industry in terms of building construction. There is a big need to look at the interior design and material finishes, as this is the focus of interior designers projects. Developing a design guide to help designers select luxury sustainable material finishes for high-end hotel guestrooms is only the beginning; and this knowledge can be applied in residential projects as well.

- Combining the objective element with the subjective element will open new doors for rating systems. Current rating systems focus only on numbers, which cannot satisfy interior designers and hotel owners, who are also looking at aesthetic qualities.

- What is being proposed in this thesis will not only help designers within their high-end hotel projects, but it can be applied to other building industry projects. Furthermore, this can help BREEAM and other assessment methods to develop and cover more material finishes and combine with the subjective

element. The research goes beyond sustainable luxury material finishes, highlighting the importance of health and well-being of users. Moreover, this research shows that sustainable material finishes do not necessarily look cheap, but can in fact be luxurious.

- This research adopted a mixed-methods approach for data collection, which involved a case study, interviews and questionnaires, which were analysed and the findings used in creating the carpet test questionnaire. This methodology is unique, especially on luxury sustainable hotel material finishes, where the researcher did not find any previous study that used the same combination of methods.

- The study has revealed there is limited data on sustainable material selection. The researcher believes that use of the design guide will help designers avoid the problems associated with selecting sustainable material finishes.

- The proposed design guide is flexible and can be applied to all building material finishes, as it consists of the basic four stages of any design process.

6.5 Opportunities for further research

This research is a small piece in a big puzzle, and there are many opportunities to develop it, including:

- Specifying more luxury interior finishes, where there are many material finishes within the interior space that can be given luxury standards or specifications

- Covering the health and well-being aspect when running an LCA method for material finishes. BRE covers the environment impact of material finishes in its environmental profiles, but only during the manufacturing process, not during the use of the material

- Developing the proposed design guide to suit other building industry projects, like residential ones, luxury office buildings or luxury retail shops

- Adding the appearance aspect to the environmental profiles by BRE and to other eco-tools

- More focus on the hotel industry, specially the luxury hotel industry by BREEAM

6.6 Recommendations

Recommendations to enhance the current situation of sustainable interior design, sustainable luxury hotels and BREEAM.

- Educate designers about sustainable material finishes and their impact on health and well-being

- Educate hotel owners on ways to follow sustainability in terms of their buildings construction and interiors, even in the case of old buildings

- BREEAM should encourage manufacturers to obtain environmental profiles for all their materials by reducing the cost and making the process easier

- Developing the BRE green guide to cover more material finishes

- Developing the BRE green guide to cover the hospitality industry, specifically the high-end hotel sector

- Reducing the cost of BREEAM certifications to encourage hoteliers and others in the building industry to embrace sustainability

- Reduce the cost of running LCAs to produce BRE environmental profiles for materials and products to encourage more manufacturers to produce environmental profiles for their materials and products. This will help manufacturers improve their materials, reduce their environmental impact and help designers in selecting sustainable materials in the design concept stage.

6.7 Limitations

This research started in January 2015 and was supposed to use Jordan as the area of the research. For security reasons, where a coordinated series bombing attacks targeted three hotels on 9 November 2005, killing 60 people and injuring 115 others, the Jordanian government ordered hotels not to allow anyone to enter without being a guest. Researchers and students are not allowed to ask for hotel plans or to take photos of the rooms. The refusal of all hotels to engage in this research for security reasons was a major impediment to continuing within Jordan area. Therefore, the researcher discussed this with the research team and agreed to carry out the research within London area. This choice was made for several reasons, as presented in chapters 1 and 3.

As with any research project, there were challenges, including:

- The lack of literature regarding the definition of luxury within interior design, interior material finishes and the hotel context.
- The research context was limited to London luxury hotels, designers, and the subject of luxury sustainable finishes was limited to the carpet flooring.
- Challenges in collecting observational and interview data in person.
- Only one luxury hotel in London agreed to be a case study, and gave the researcher the approval to mention their hotel in the research. This was also the only hotel approved to share their carpet specifications, while all other luxury hotels declined any access to their rooms.

- Reaching out to designers in London was almost impossible. The researcher spent a very long time emailing and calling designers for interviews, but the response was really weak, where most of them did not answer emails and calls, or just responded with refusals, which affected the research timeframe and slowed the process of data collection. At the same time it limited and decreased the number of the research interviews.
- The researcher was not allowed to interview luxury hotel guests in London or even send them the survey.
- Restrictions in terms of a lack of funding for transportation to and within London to carry on with the data collection.

  The difficulties accessing the code of conduct book for any of the five-star hotels to help the researcher understand their standards of design, materials, colours and furniture etc.

6.8 Concluding comments

This research aimed to develop a design guide for luxury sustainable material finishes for high-end hotels to assist designers in selecting luxury sustainable finishes for their hospitality projects, which can also be applied to other luxury buildings projects. The specific objectives of this study were:

1- To investigate sustainable development within the interior design of the luxury hotel industry in London.
2- To establish a basic definition of luxury material finishes for five-star luxury hotel guestrooms, from both primary and secondary research data.
3- To determine from designers and hotel owners the specifications of a luxury carpet material for high-end hotel guestrooms.
4- To investigate the challenges faced by designers when designing a luxury sustainable hotel.
5- To produce a tool for specifying luxury materials and finishes (using carpets as a case study) and combine this with an existing eco-tool to help

designers in selecting luxury sustainable materials and finishes in the design concept stage

This research proposed guidelines to support designers when selecting luxury sustainable material finishes. Narrowing the range of possibilities at the same time will guide hoteliers to the possibility of using and implementing sustainable material finishes without compromising on luxury. In addition, it will help manufacturers to start producing material finishes that combine luxury and sustainability for the luxury sector.

More research in this field will offer interior designers with a knowledgeable procedure precisely to the design difficulties they experience in designing sustainability within the hotel industry. This research will provide interior designers and hoteliers with a guideline/rating system for sustainable luxury materials for high-end hotels' interior design, which will provide knowledge to the hospitality industry and better allow interior designers to assist the progress of the hotel industry towards joining the wave of sustainability revolution. This may contribute to a valuable insight and provide a foundation for greater, more comprehensive information, counting more types of finishes identified in hotel design. Moreover, it will help future studies to develop this work and benefit from this framework to develop better luxury sustainable materials for the hospitality industry.

Bibliography

International Energy Agency, 2011. *CO2 emissions from fuel combustion,* Paris: OESD/EIA.

AA hotel services, 2015. *Guest Accommodation quality standards,* Basingstoke: AA hotel services .

Ahn, Y. H. & Pearce, A. R., 2013. GREEN LUXURY: A CASE STUDY OF TWO GREEN HOTELS. *Journal of Green Building,* 8(1), pp. 90-119.

Akadiri, P. O., Chinyio, E. A. & Olomolaiye, P. O., 2012. Design of A Sustainable Building: A Conceptual Framework for Implementing Sustainability in the Building Sector. *buildings,* pp. 126-152.

Ali, Y. et al., 2008. Potential of energy savings in the hotel sector in Jordan. *Energy Conversion and Management,* 49(11), pp. 3391-3397.

Allione, C., Giorgi, C. D., Lerma, B. & Petruccelli, L., 2012. From ecodesign products guidelines to materials guidelines for a sustainable product. Qualitative and quantitative multicriteria environmental profile of a material. *Energy,* pp. 90-99.

Alvesson, M. & Sköldberg., K., 2000. *Reflexive Methodology: New Vistas for Qualitative Research.* London: Sage.

Anderson, J., Shiers, d. & Steele, K., 2009. *The green guide to specification.* 4th ed. London: BRE.

Anon., 1989. *The Dorchester.* London: s.n.

Araji, M. T. & Shakour, S. A., 2013. Realizing the environmental impact of soft materials: Criteria for utilization and design specification. *Materials and Design ,* Volume 43, pp. 560-571.

Atwal, G. & Williams, A., 2009. Luxury brand marketing — The experience is everything!. *Journal of Brand Management,,* 16(5), pp. 338-346.

Ayalp, N., 2013. Multidimentional Aproach To Sustainable Interior Design Practice. *International Journal of Energy and environment ,* 7(4), pp. 143-151.

Ayikoru, M., 2009. *Epistemology, ontology and tourism.* s.l.:Channel View Publications, Ltd. .

Babbie, E., 1990. *Survey research methods.* 2nd ed. Belmont: WadsworthPub. Co..

Barlow, S., 2011. *Guide to BREEAM,* London: RIBA.

Barnier, V. D., author, S. F. & Valette-Florence, P., 2012. Do consumers perceive three levels of luxury? A comparison of accessible, intermediate and inaccessible luxury brands. *Journal of Brand Management,* 19(7), p. 623–636.

Beaverstock, J., Hubbard, P. & Short, J. R., 2004. Getting away with it? Exposing the geographies of the super-rich. *Geoforum,* 35(4), pp. 401-407.

Bell, M., 2005. Peer observation partnerships in higher education. *Studies in Higher Education,* 32(1), pp. 135-147.

Bergman, D., 2011. *Sustainable design: A critical guide.* 1st ed. New York: Princeton Architectural Press.

Berg, M. & Eger, E., 2003. *Luxury in the Eighteenth Century.* 1st ed. s.l.:Palgrave Macmillan UK.

Biehl, M., Realff, M. & Prater, E., 2007. Assessing performance and uncertainty in developing carpet reverse logistics systems. *Computers & Operations Research ,* 34(2), pp. 443-463.

Bilhuber, J., 2008. *Defining Luxury.* 1st ed. s.l.:Rizzoli International Publications.

Binggeli, C., 2008. *Materials for interior environments.* Canada: John Wiley & Sons, Inc. .

Bird, L., 2014. *Carpet recycling in the UK.* Birmingham , s.n.

Blaikie, N. W. H., 2010. *Designing social research.* 2nd ed. Cambridge: Polity Press Ltd. .

Blaikie, N. W. H., 2010. *Designing social research: the logic of anticipation.* 2nd ed. Cambridge: Polity.

Bohdanowicz, P. & Martinac, I., 2016. *ATTITUDES TOWARDS SUSTAINABILITY IN CHAIN HOTELS – RESULTS OF A EUROPEAN SURVEY.* [Online]
Available at:
https://www.researchgate.net/publication/268295114_ATTITUDES_TOWARDS_SUSTAINABILITY_IN_CHAIN_HOTELS_-_RESULTS_OF_A_EUROPEAN_SURVEY
[Accessed 4 September 2017].

Bonda, P. & Sosnowchik, K., 2007. *Sustainable Commercial Interiors.* New Jersy: John Wiley & Sons, Inc. .

Bowyer, D. J., Bratkovich, D. S., Fernholz, K. & Lindburg, A., 2009. *Life cycle assessment of flooring materials: a guide to intelligent selection,* s.l.: Dovetail Partner Inc..

Brannen, J., 1992. *Mixing methods: qualitative and quantitative research.* 1st ed. s.l.:Aldershot: Avebury.

BRE, 2012. *BREEAM International New Construction Technical Manual,* s.l.: BRE Global Ltd..

BRE, 2016. *Green book live.* [Online]
Available at: http://www.greenbooklive.com/pdfdocs/envprofiles/ENP353co.pdf
[Accessed 8 4 2018].

BRE, 2018. *BREEAM.* [Online]
Available at: https://www.breeam.com/
[Accessed 19 March 2018].

British Standards Institute, 2016. *BS EN 1307:2014+A1: 2016: Textile floor coverings-classification,* s.l.: British Standards Institute.

Brody, D., 2014. Go Green:Hotels, Design, and the Sustainability Paradox. *Design Issues ,* pp. 5-15.

Bryman, A., 2012. *Social research methods.* Oxford: Oxford University Press.

Bryman, A. & Bell, E., 2015. *Business research methods.* 4th ed. Oxford: Oxford University Press.

Callan, R. J., 1995. Hotel classification and grading schemes, a paradigm of utilisation and user characteristics. *Int. J. Hospitality Management ,* pp. 271-284.

Canales, G., 2013. Transformative, Mixed Methods Checklist for Psychological Research With Mexican Americans. *Journal of mixed methods research,* 7(1), pp. 6-21.

Collins, K. M. T., 2010. *Advanced Sampling Designs in Mixed Research: Current Practices and Emerging Trends in the Social and Behavioral Sciences.* 2nd ed. s.l.:SAGE.

Creswell, J., 2003. *Research design: qualitative, quantitative, and mixed methods approaches.* 2nd ed. London: SAGE.

Creswell, J., 2007. *Qualitative inquiry and research design: choosing among five approaches.* 2nd ed. London: SAGE.

Creswell, J., 2013. *Qualitative inquiry & research design: choosing among five approaches.* 3rd ed. London: SAGE.

Creswell, J. & Clark, P., 2007. *Designing and conducting mixed methods research.* California; London: Thousand Oaks: Sage.

Creswell, J. W., 2006. *Qualitative Inquiry and Research Design: Choosing among Five Approaches.* 2nd ed. s.l.:SAGE publications.

Creswell, J. W. & Clark, P., 2011. *Designing and conducting mixed methods research.* 2nd ed. London: Thousand Oaks .

Creswell, J. W. & Creswell, J. D., 2018. *Research Design: Qualititative, Quantitative and mixed methods approach.* 5th Edition ed. Glasgow: SAGE Publications.

CRI, 2018. *The carpet primer,* Dalton: the Carpet and Rug Institute, Inc..

Dane, F., 1990. *Research methods.* 1st ed. California: Pacific Grove .

Dawson, C., 2002. *Practical Research Methods.* 1st ed. Oxford: How To Books Ltd..

De-Miguel-Molina, B., De-Miguel-Molina, M. & Rumiche-Sosa, M., 2012. Luxury resorts and sustainable tourism in the maldives. In: *Research Studies on Tourism and Environment.* Valencia, Spain: Nova Science Publishers, Inc., pp. 157-167.

Denzin, N. K. & Lincoln, Y. S., 2000. *Handbook of qualitative research.* 2nd ed. London: Sage Publications, Thousand Oaks.

Dorchester, 2017. *Dorchester collection.* [Online]
Available at: https://www.dorchestercollection.com/en/
[Accessed 2 March 2017].

DUBOIS, B., CZELLAR, S. & CZELLAR, S., 2005. Consumer Segments Based on Attitudes Toward Luxury: Empirical Evidence from Twenty Countries. *Marketing Letters,* 16(2), pp. 115-128.

Dutfield, A., Mundy, J. & Anderson, J., 2011. *Environmental impact of floor finishes,* Watford: BRE press.

Elliott, A. & Urry, J., 2010. *Mobile Lives.* 1st ed. London: Routledge .

Environmental Protection Agency , 2012. *United States Environmental Protection Agency.* [Online]
Available at: https://www.epa.gov/environmental-topics
[Accessed 7 March 2017].

Fellows, R. F. & Liu, A., 2003. *Research Methods for Construction.* 2nd ed. Oxford: Blackwell Science.

Filstead, W. J., 1979. Qualitative methods: A needed perspective in evaluation research. *Qualitative and Quantitative Methods in Evaluation Research,* pp. 33-48.

Fowler, K. & Rauch, E., 2006. *Sustainable building rating systems summary,* USA: Pacific Northwest National Laboratory.

Gall, M. D., Gall, J. P. & Borg, W. R., 2006. *Educational research: An introduction.* 8th ed. Boston: Allyn and Bacon.

Gardetti, M. A. & Muthu, S. S., 2015. *Handbook of Sustainable luxury textiles and fashion.* London: Springer science .

Gladwin, T. N., Kennelly, J. J. & Krause, T.-S., 1995. Shifting Paradigms for Sustainable Development: Implications for Management Theory and Research. *Shifting Paradigms for Sustainable Development: Implications for Management Theory and Research,* 20(4), pp. 874-907.

Global Development Research Center, 2008. *The Global Development Research Center.* [Online]
Available at: http://www.gdrc.org/sustdev/why-sustdev.html
[Accessed 7 March 2017].

Goddard, W. & Melville, S., 2007. *Research Methodology: An Introduction.* 2nd ed. Lansdowne: Juta & Co. Ltd.

Godsey, L., 2017 . *Interior design materials and specifications.* Third edition ed. New York: Bloomsbury Publishing Inc.

Graziano, a. M. & Raulin, M. L., 2007. *Research Methods.* 6th ed. New York: Pearson Education, Inc..

Greene, J. C., 2007. *Mixed methods in social inquiry.* 1st ed. San Francisco: Jossey-Bass.

Greene, J. C., 2007. Mixed Methods in Social Inquiry. *Journal of Mixed methods research ,* 2(2), pp. 190-198.

Gustafsson, J., 2017. Single case studies vs. multiple case studies: A comparative study.

Haija, A. A. A., 2011. Jordan: Tourism and conflict with local communities. *Habitat International,* 35(1), pp. 93-100.

Han, J. H. & Kim, S. S., 2014. Architectural Professionals' Needs and Preferences for Sustainable Building Guidelines in Korea. *Sustainability ,* 6(12), pp. 8379-8397.

Hawken, P., 1993. *The ecology of commerce: A declaration of sustainability.* 1st ed. New York: HarperCollins Publishers .

Hayles, C. S., 2015. Environmentally sustainable interior design: A snapshot of current supply of and demand for green, sustainable or Fair Trade products for interior design practice. *International Journal of Sustainable Built Environment,* Volume 4, pp. 100-108.

Heide, M. & Grønhaug, K., 2009. Key Factors in Guests' Perception of Hotel Atmosphere. *Cornell Hospitality Quarterly ,* 50(1), pp. 29-43.

Hennigs, N., Wiedmann, K.-P., Klarmann, C. & Behrens, S., 2015. The complexity of value in the luxury industry. *International Journal of Retail & Distribution Management,* 43(10), pp. 922-939.

Henn, M., Weinstein, M. & Ford, N., 2005. *A short introduction to social research.* s.l.:Sage.

Hilton, M., 2004. The legacy of luxury. *Journal of consumer culture,* 4(1), pp. 101-123.

Husic, M. & Cicic, M., 2009. Luxury consumption factors. *Journal of Fashion Marketing and management,* 13(2), pp. 231-245.

Hussein, M. F., 2011. THE IDEAL USAGE OF SUSTAINABLE MATERIALS AND LOCAL RESOURCES OF THE INTERIOR SPACE DESIGN IN JORDAN. *Journal of energy and power engineering.*

Johnson, R. B., Onwuegbuzie, A. J. & Turner, L. A., 2007. Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research,* 1(2), pp. 112-133.

Jones, L., 2008. *Environmentally responsible design: green and sustainable design for interior designers.* Canada: John Wiley & Sons, Inc. .

Jones, P., Hillier, D. & Comfort, D., 2013. Sustainability in the global hotel industry. *International Journal of Hospitality Management,* 26(1), pp. 5-17.

Kang, M. & Guerin, D. A., 2009. The State of Environmentally Sustainable Interior Design Practice. *American Journal of Environmental Sciences,* pp. 179-186.

Kapferer, J.-N., 2010. *All that Glitters is not Green: The challenge of sustainable luxury.* [Online] Available at: www.europeanbusinessreview.com
[Accessed 16 March 2016].

Kapferer, J.-N., 2015. The future of luxury: Challenges and opportunities. *Journal of Brand Management,* 21(9), pp. 716-726.

Kapferer, J.-N. & Michaut, A., 2010. All that Glitters is not Green: the challenge of sustainable luxury. *The European Business Review,* November-December.pp. 40-45.

Kapferer, J.-N. & Michaut-Denizeau, A., 2014. Is luxury compatible with sustainability? Luxury consumers' viewpoint. *Journal of Brand Management,* Volume 1, pp. 123-156.

Kasim, A., 2004. Socio-environmentally responsible hotel business: Do tourists to Penang Island, Malaysia care?. *Journal of Hospitality & Leisure Marketing,* 11(4), pp. 5-28.

Kiessling, G., Balekjian, C. & Oehmichen, A., 2009. What credit crunch ? More luxury for new money: European rising stars & established markets. *Journal of Retail & Leisure Property,* 8(1), pp. 3-23.

Kirk, D., 1995. Environmental management in hotels. *International Journal of Contemporary Hospitality Management,* 7(6), pp. 3-8.

Kothari, C. R., 2012. *Research Methodology: Methods and Techniques.* 3rd ed. New Delhi: New Age International Publisher .

Kuhlman, T. & Farrington, J., 2010. What is Sustainability?. *Sustainability,* 2(11), pp. 3436-3448.

Kumar, R., 2014. *Research Methodology : A Step-by-Step Guide for Beginners.* 4th ed. London: SAGE Publications.

Kunz, M. N., 2003. *Luxury Hotels: Europe.* Kempen: teNeues Publishing UK Ltd.

Kyngas, H. & Lauri, S., 2005. *Developing nursing theories.* Vantaa, Finland: Werner Soderstrom, Dark Oy.

Lee, A. S., 1991. INTEGRATING POSITIVIST AND INTERPRETIVE APPROACHES TO ORGANIZATIONAL RESEARCH. *Organization Science,* 2(4), pp. 342-365.

Lee, E., Allen, A. & Kim, B., 2013. Interior Design Practitioner Motivations for Specifying Sustainable Materials: Applying the Theory of Planned Behavior to Residential Design. *Journal of Interior Design,* 38(4), pp. 1-16.

Line, N. D. & Hanks, L., 2015. The effects of environmental and luxury beliefs on intention to patronize green hotels: the moderating effect of destination image. *Journal of Sustainable Tourism,* 24(6), pp. 904-925.

Lippiatt, B. C., 2002. *Building for Environmental and Economic Sustainability Technical Manual and User Guide: BEES 3.0,* Gaithersburg: National Institute of Standards and Technology .

Lithner, J., 2008. A research framework for creative and imitative reasoning. *Educational studies in mathematics,* 67(3), pp. 255-276.

Lithner, J., 2008. A research framework for creative and imitative reasoning. *Educational studies in mathematics,* 67(3), pp. 255-276.

Livesey, K., 2012. *www.bre.co.uk.* [Online]
Available at: https://www.bre.co.uk/page.jsp?id=2412
[Accessed 24 September 2017].

MÁTÉ, K., 2009. *ATTITUDES VERSUS ACTIONS: ARE INTERIOR DESIGNERS GENUINELY EMBRACING SUSTAINABLE DESIGN THROUGH MATERIAL SELECTION?.* Wellington, Fifth International Conference of the Association of Architecture Schools in Australasia.

Manchanda, S. & Steemers, K., 2009. *Sustainability & Satisfaction: Findings from field studies of office buildings in the UK and India.* Canada, Conference on Passive and Low Energy Architecture.

Mawell, J. A., 2013. *Qualitative research design: an interactive approach.* s.l.:SAGE Publications.

Mayes, D. et al., 2014. *London and Paris Luxury Hotels: Market Report 2014,* London: Knight Frank.

McDonough, W. & Braungart, M., 2002. *Cradle to Cradle: Remaking the Way We Make Things.* New York: North Point Press.

McGillick, P., 2015. *Sustainable luxury: the new Singapore house solutions for a livable future.* s.l.:Tuttle Publishing.

McGivney, F., 2015. *Hotels UK, Novomber 2015,* s.l.: Mintel Group .

Mclennan, J. F., 2004. *The Philosophy of Sustainable Design: The Future of Architecture.* 1 ed. Kansas: Ecotone Publishing Company.

Mendler, S. F., Odell, W. & Lazarus, M. A., 2005. *The HOK Guidebook to Sustainable Design.* s.l.:John Wiley & Sons.

Mertens, D. M., 1998. *Research methods in education and psychology: integrating diversity with quantitative & qualitative approaches.* London: Thousand Oaks, Sage.

Miller, R. L. & Brewer, J. D., 2003. *The AZ of social research: A dictionary of key social science research concepts.* London: Sage publications Ltd..

mintel, 2015. *luxury travel,* s.l.: Mintel group Ltd..

Moffatt, I., Hanley, N. & Wilson, M., 2001. *Measuring and modelling sustainable development.* New York: Parthenon pUblication Group.

Moxon, S., 2012. *Sustainability in interior design.* 1st ed. London: Laurence King Publishing.

Myers, M., 2013. *Qualitative research in business and management.* s.l.:Sage.

Nachmias, F. & Nachmias, C. D., 1996. *Research methods in the social sciences.* 5th ed. London: Edward Arnold.

Naoum, D. S. G., 2012. *Dissertation Research and Writing for Construction Students.* 3rd ed. s.l.:Routledge Ltd..

Newman, I., Ridenour, C. S., Newman, C. & DeMarco, G. M., 2003. A typology of research purposes and its relationship to mixed methods. In: T. Oaks, ed. *Handbook of mixed methods in social and behavioral research* . s.l.:SAGE, pp. 167-188.

Onwuegbuzie, A. J. & Leech, N. L., 2006. Linking research questions to mixed methods data analysis procedures. *the qualitative report ,* 11(3), pp. 474-498.

Paul, W. L. & Taylor, P. A., 2007. A comparison of occupant comfort and satisfaction between a green building and a conventional building. *Building and Environment,* p. 1858–1870.

PHAU, I. & PRENDERGAST, G., 2000. Consuming luxury brands: The relevance of the 'Rarity Principle'. *Journal of brand management ,* 8(2), pp. 122-138.

Picardi, C. A. & Masick, K. D., 2014. Introduction to Research Methods . In: *Research Methdos: Designing and Conducting Research with a Real-World Focus.* 1 ed. California: SAGE Publications, p. 3.

Pilatowicz, G., 1995. *Eco-Interiors: A guide to envieonmentally conscious interior design.* Canada: John Wiley & Sons, Inc. .

Ponterotto, J. G., 2005. Qualitative research in counseling psychology: A primer on research paradigms and philosophy of science. *Journal of Counseling Psychology,* 52(2), pp. 126-136.

Rajasekar, S., Philominathan, P. & Chinnathambi, V., 2006. Research methodology.

Reeder, L., 2010. *Guide to green building rating systems: understanding LEED, green globes, ENERGY STAR, the National Green Building Standard, and more.* Hoboken, New Jersey: John Wiley & Sons.

Rider, T. R., 2009. *Understanding Green Building Guidelines: for students and young professionals.* First Edition ed. New York: W. W. Norton & Company.

Robson, C., 2002. *Real world research: a resource for social scientists and practitioner-researchers.* 2nd ed. Oxford: Blackwell.

Rotimi, A. et al., 2017. Estimation and Validation of Energy Consumption in UK Existing Hotel Building Using Dynamic Simulation Software. *Sustainability ,* 9(8), p. 1391.

Rubin, A. & Babbie, E., 2012. *Essential research methods for social work.* s.l.:Cengage learning .

Rubin, A. & Babbie, E. R., 2013. *Essential research methods for social work.* 2nd ed. Belmont: Brooks-Cole.

Sandelowski, M., 1995. Qualitative analysis: What it is and how to begin. *Research in Nursing & Health,* 18(4), pp. 371-375.

Saunders, M., LEWIS, P. & THORNHILL, A., n.d. *Research methods for business students.* 7th ed. Harlow: Pearson Education.

Seale, C., 2004. *Researching society and culture.* 2nd ed. London: Sage.

Silverstein, M. J. & Fiske, N., 2003. Luxury for the Masses. *Harvard business review,* 81(4), pp. 48-57.

Sloan, P., Legrand, W. & Chen, J. S., 2013. *Sustainability in the hospitality industry.* 2nd ed. Canada: Routledge.

Sotayo, A., Green, S. & Turvey, G., 2015. Carpet Recycling: A review of recycled carpets for structural composites. *Environmental technology and innovation,* Volume 3, pp. 97-107.

Spiegle, R. & Meadows, D., 2012. *Green building materials: A guide to product selection and specifications.* 3rd ed. Canada: John Wiley and Sons, Inc. .

Stemler, S., 2001. An overview of content analysis. *Practical Assessment, Research and Evaluation,* 7(17), pp. 1-6.

SU, C.-S. & SUN, L.-H., 2007. Taiwan's Hotel Rating System A Service Quality Perspective. *SAGE Journal,* 48(4), pp. 392-401.

Tashkkori, A. & Teddlie, C., 1998. *Mixed methodology: combining qualitative and quantitative approaches.* London: Thousand Oaks, Sage.

Taylor, S. J., Bogdan, R. & Devault, M., 2015. *Introduction to Qualitative Research Methods : A Guidebook and Resource.* 4th ed. US.: John Wiley & Sons Inc. .

Thomas, D., 2008. *Deluxe: how luxury lost its lustre.* London: Penguin.

Treloar, G. J., McCoubrie, A., Love, P. E. & Iyer-Raniga, U., 1999. Embodied energy analysis of fixtures, fittings and furniture in office buildings. *Facilities,* 17(11), p. 403±409.

Tungate, M., 2009. *Luxury World: The Past, Present and Future of Luxury Brands.* 1st ed. London: Kogan Page Publishers.

Tynan, C., McKechnie, S. & Chhuon, C., 2010. Co-creating value for luxury brands. *Journal of business research,* Volume 63, p. 1156–1163.

UNWTO, 2017. *UNWTO.* [Online]
Available at: http://media.unwto.org/content/infographics
[Accessed 21 March 2018].

Veblen, T., 1899. *The theory of the leisure class.* 1st ed. s.l.:Macmillan company.

Vigneron, F. & Johnson, L. W., 1999. A Review and a Conceptual Framework of Prestige-Seeking Consumer behavior. *Academy of Marketing Science,* 1999(1).

Watson, H., 2005. *Hotel revolution.* Chichester : John Wiley .

Wiedmann, K.-P., Hennigs, N. & Siebels, A., 2007. Measuring Consumers' Luxury Value Perception: A Cross-Cultural framework. *Academy of Marketing Science,* 2007(7).

Wilby, R., 2007. A Review of Climate Change Impacts on the Built Environment. *Built Environment ,* 33(1), pp. 31-45.

Williams, K. & Dair, C., 2007. A framework for assessing the sustainability of brownfield development. *Journal of Environmental Planning and Management,* 50(1), pp. 23-40.

Winchip, S., 2007. *Sustainable design for interior environmnets.* New York: Fairchild.

World Commission on Environment and Development , 1987. *Our common future: The Brundtland Report,* New York : Oxford University Press.

Yang, W. & Mattila, A. S., 2016. Why do we buy luxury experiences? Measuring value perceptions of luxury hospitality services. *International Journal of Contemporary Hospitality Management,* 28(9), pp. 1848-1867.

Yang, Y., Fenghu, W. & Xiaodong, Z., 2011. *Contrast Study on Interior design with low-carbon and traditional design.* Shanghai, International Conference on Materials for Renewable Energy and Environment.

Yin, R. K., 1994. *Case study research: design and methods.* 2nd ed. Calif; London: Thousand Oaks: Sage.

Appendices

Appendix A: Designers questionnaire and answer sample

Sustainable luxury interior design materials for five-star hotel

Introduction and Purpose of the survey

My name is Ruba JadAllah and I'm a doctoral candidate in the Doctorate in interior design program at De Montfort University School of Art and Design. I am in the process of writing my doctoral dissertation and am collecting data for that purpose. For my doctoral dissertation I am very interested in defining "Luxury" materials for five-star hotels in the opinion of hoteliers, guests, and interior designers. Additionally, I am interested in designing a guide of sustainable luxury materials for five-stars hotel to assist interior designers and hoteliers with choosing a sustainable, luxury and cost-efficient materials. The purpose of this survey is to ask for your assistance by agreeing to be a participant in this study, knowing that All the information to be provided will be used solely for the purpose of this study. All data will be treated confidentially.
Please ask any questions that you have about participating in this project at any time. I want you to have the information you need to make a decision that is best for you.

If you wish to participate in the research study, please click on the "agree" button.

- [x] Agree

Are you:

- [x] Architect
- [ ] Interior designer

Level of education:

- [ ] Graduate
- [x] Postgraduate
- [ ] Other: _____

Practice:

- [ ] Academic
- [x] Private
- [ ] Public

Years of practice:

- [ ] 3-5
- [ ] 5-10
- [ ] 10-15
- [x] Above 15

Do you have knowledge designing five-star hotels or have you designed one before?

- [x] Yes
- [ ] No

Based on your experience what is the hotel owner's priority?
(You can choose more than one answer if it's appropriate)

- [ ] Lowest cost
- [ ] Sustainability
- [x] Space efficiency
- [x] Luxury
- [ ] Other: _____

Do you think guests of five star luxury hotels are interested in sustainable design ?

- [x] Yes
- [ ] No

Do you think guests of five star luxury hotels are more interested in luxury elements, whether these are sustainable or not?

- [x] Yes
- [ ] No

As a designer how would you define 'luxury' interior material finishes for the guest rooms in five star hotels?
(You can choose more than one answer if it's appropriate)

- [ ] Go beyond the standards of five-star hotels
- [ ] The highest cost materials
- [x] High level of detailing, premium materials and fine finishes
- [ ] Unique materials
- [ ] Modern materials
- [ ] Other: _____

Do you have a sustainability interest?

- [x] Yes
- [ ] No

If yes, do you genuinely embrace sustainable design through material selection?

- [x] Yes
- [ ] No

What specific materials you have selected which meet the sustainability criteria?

Recycled or sustainably sourced insulation. Sustainably sourced timber,

What are the hardest challenges you face designing five star hotel with luxury sustainable interior design?
(You can choose more than one answer if it's appropriate)

- [ ] Higher cost
- [ ] Quality issue
- [x] Limited source-book of sustainable luxury materials
- [ ] Hoteliers needs
- [ ] Other: _____

How a guideline for luxury sustainable materials specifications would help you designing a five star hotel ?

It would reduce the research time necessary to source such materials, thus making the process more efficient.

Appendix B: Luxury hotel guests questionnaire and answer sample

Luxury sustainable materials for five star hotels

My name is Ruba JadAllah and I'm a doctoral candidate in the Doctorate in interior design program at De Montfort University School of Art and Design. I am in the process of writing my doctoral dissertation and am collecting data for that purpose. For my doctoral dissertation I am very interested in redefining "Luxury" materials for five-star hotels in the opinion of hoteliers, guests, and interior designers. Additionally, I am interested in designing a guideline of sustainable luxury materials for five-stars hotel to assist interior designers and hoteliers with choosing a sustainable, luxury and cost-efficient materials. The purpose of this survey is to ask for your assistance by agreeing to be a participant in this study, knowing that All the information to be provided will be used solely for the purpose of this study. All data will be treated confidential.

Please ask any questions that you have about participating in this project at any time contacting me on this email [Ruba.jadallah@my365.dmu.ac.uk]. I want you to have the information you need to make a decision that is best for you.

Thank you for your cooperation.

If you wish to participate in the research study, please click on the "agree" button. *

- (●) Agree
- ( ) Not agree

Gender

- [x] Male
- [ ] Female

Age

- [ ] 18-24
- [ ] 25-34
- [ ] 35-44
- [x] 45-54
- [ ] 55-64
- [ ] 75 or older

What are your main reasons for travelling usually? *

(You can select more than one answer).

- [ ] Visiting relatives and friends.
- [x] Relaxation and wellness.
- [x] Business reasons.
- [ ] Health.
- [ ] Events/Wedding.
- [ ] Leisure.
- [ ] Attending a conference.
- [ ] Other: _____

How do you choose a hotel to stay in? *
(You can select more than one answer).

- [x] Hotel location.
- [ ] Friends and family recommendations.
- [ ] Websites guest reviews like (Booking.com or TripAdvisor).
- [x] Based on the hotel website photos.
- [x] Hotel facilities.
- [ ] Price.
- [ ] based on you work and your company selection
- [ ] Other: _____

What are the elements that you consider when you chose a hotel in term of the guestroom? *
(You can select more than one answer).

- [x] Size of the guestroom.
- [x] Design style.
- [ ] color scheme
- [x] Room facilities.
- [x] Bathroom size and facilities.
- [x] Finishing materials used in interior design.
- [x] Furniture quality.
- [ ] Other: _____

As a five-star hotel visitor, and a luxury staying seeker, how do you define a "luxury guestroom"? *

Best facilities, furniture and comfy

In your opinion, what is a luxury guestroom flooring material? *
(You can select more than one answer).

- [ ] Hardwood flooring.
- [x] Natural stone flooring like marble.
- [ ] Mosaic and Designer Ceramic Floor Tiles.
- [ ] Vinyl tiles.
- [x] Wall to wall Carpet.
- [x] Carpet with hardwood.
- [x] Carpet with natural stone like marble.
- [ ] Other: _____

If the guest room floor was wall to wall carpet or part of it is carpet, what kind of carpet material would you like to see? *

- [ ] Cotton carpet
- [x] Natural Silk Carpet.
- [ ] Wool carpet.
- [ ] Art silk carpet (Man made silk).
- [ ] Synthetic carpet (man made) like Polypropylene, Polyester, and Nylon.
- [ ] Mix of wool and synthetic carpet.
- [ ] Mix of wool and silk.
- [ ] Mix of silk and synthetic carpet.
- [ ] Other: _____

As hotels started to follow sustainability in many different ways, to what extent do you agree or disagree with the following sustainability practices?

(Please select one answer per row knowing that 1 is highly agree and 7 is highly disagree).

	1	2	3	4	5	6	7
No daily bedding change.	○	○	○	○	○	○	◉
Reduce energy consumption by exchanging to LED light bulbs.	◉	○	○	○	○	○	○
Reduce water consumption by recycling water.	◉	○	○	○	○	○	○
Using healthy and non-toxic material finishes.	◉	○	○	○	○	○	○
Eliminating the use of towels by not washing it daily.	○	○	○	○	○	○	◉
Waste recycle.	◉	○	○	○	○	○	○
Using local food.	◉	○	○	○	○	○	○

Do you support the idea of a luxury sustainable hotel? *

- ◉ Yes
- ○ No
- ○ Maybe

If you have a choice, where do you prefer to stay: *

- ○ A luxury hotel.
- ◉ A luxury sustainable hotel.

Appendix C: Interviews' Instruments

1- Architects and interior designers (DS) interview questions

➢ Semi-structured questions

1- Have you worked before on any hospitality projects and do you have knowledge on designing five-star hotels?
2- Does your company have an interest in sustainability?
3- Do you genuinely embrace sustainable design through materials selection?
4- If yes, what kind of sustainable materials do you deal with? And from where? Can you name companies or manufacturers you deal with?
5- What kind of challenges do you face when designing sustainably?
6- From your experience, what are hotel owners' priorities?
7- How would you define "Luxury" in terms of the interior design material finishes of five-star hotel guest rooms, specifically the carpet?
8- Do you think that hotel guests are interested in sustainability?
9- Are the hotel guests more interested in luxury than sustainability?
10- What is the process you undertake in designing a hotel and how do you specify material finishes?

2- Hotel managers (HM) interview questions

➢ Semi-structured questions

1- How is your hotel classified?

2- Is the rating of five-star hotels related to luxury?

3- As a hotel manager, what are the things you focus on in terms of hotel interior design?

4- How would you define luxury in terms of hotel guest room interior design? And what are the specifications of a luxury carpet?

5- What kind of visitors does your hotel host most of the time?

6- Do you have loyal guests? And why do they keep coming back?

7- When were the last renovations?

8- Do you remove the flooring materials like carpet when you do the renovations? If yes, what do you do with them?

9- Does your hotel have any certification showing it is environmentally friendly?

10- Is your hotel seeking to get any certification?

11- Do you think that hotel guests are interested in sustainability?

12- Are the hotel guests more interested in luxury than sustainability?

13- Did you use sustainable material finishes in the last renovation?

3- Manufacturers (MF) interview questions

1- What kind of sustainable flooring material does your company provide and what is special about it?
2- Does your manufacturer have any certificate from any green building rating system organisation?
3- Do you think recycled materials are environmentally friendly?
4- What kind of projects do you provide with your flooring materials and why do they choose your materials?
5- How do you help interior designers and architects to achieve their sustainable project? Do they have knowledge about or are aware of sustainable materials?
6- Are your sustainable material prices affordable?
7- Is there any relation between the price and the sustainability level of the carpet?
8- Are your clients usually looking for luxury carpets?
9- How would you define luxury material finishes?
10- Do you think that a design guide of luxury sustainable carpets will help manufacturers and designers to select, and specify, luxury sustainable materials?

4- BREEAM members (BM) interview questions

1- Why are hotels in London not interested in BREEAM?
2- Does BREEAM rate material finishes?
3- What is the process of assessing material finishes?
4- In your opinion, what is a luxury sustainable material finish? Specifically, what is a luxury sustainable carpet?
5- Do you think that there is a need for a guideline of luxury sustainable material finishes?

Appendix D: Carpet test questionnaire instrument

- Participant information sheet and instrument

Participant Information Sheet

Sustainable Interior Design:
A guide to assist interior designer specifying sustainable luxury carpet flooring materials for five-star hotel

Please take some time to read this information and ask questions if anything is unclear.

Contact details can be found at the end of this document.

What is the purpose of this study?

This study aims to develop a design guide of luxury sustainable carpet flooring materials for five-star hotel to assist interior designers and hoteliers with choosing a sustainable, luxury and cost-efficient materials. Design a sustainable luxury carpet flooring materials for interior designers will help both interior designers and hotel owners following the sustainable development within the hospitality sector with no hesitation.

Who is organising this research?

The research for this study is being undertaken by Ruba Jadallah who is a doctoral student in Faculty of Art, Design and Humanities at De Montfort University.

De Montfort University Research Ethics Committee has reviewed and approved this research.

Why have I been chosen?

Due to the criteria of choosing, your background knowledge fits to the criteria.

Do I have to take part?

Participation in this study is voluntary and you may ask the researcher questions before agreeing to participate. However, we believe that your contribution will assist in the interviewing process.

If you agree to participate, you will be asked to sign a consent form. However, at any time, you are free to withdraw from the study and if you choose to withdraw, we will not ask you to give any reasons.

What will happen to me if I take part?

If you agree to take part in this study you will answer the questionnaire which is provided with carpet samples for testing it.

The questionnaire will be conducted by Ruba Jadallah and will last not over 15 Minutes.

What are the possible risks of taking part?

While we hope that your experience will be pleasant, at any time during the interview you can choose to withdraw.

How will my Questionnaire answers be used?

Your questionnaire answers will be analysed and used as a guideline to develop the guide which aim to be a result.

On the consent form we will ask you to confirm that you are happy to assign your (or where relevant, your child or vulnerable adult in your legal charge) copyright for the interview to us, which means that you consent to the researcher using and quoting from your interview.

What will happen to the results of the project?

All the information that we collect about you during the course of the research will be kept strictly confidential. You will not be identified in any reports or publications and your name and other personal information will be anonymised unless you give us the permission.

What happens at the end of the project?

If you agree to participate in this project, the research will be written up as a thesis. You may request a summary of the research findings by contacting the researcher. On successful submission of the thesis, it will be deposited both in print and online at De Montfort University, to facilitate its use in further research. The digital online copy of the thesis will be deposited with De Montfort Open Research Archive ("**DORA**") and will be published with open access meaning that it will be available to all internet users. At the end of this project, the audio and digital data collected from interviews with participants will be deposited at the UK Data Service for use by future researchers.

What about use of the data in future research?

If you agree to participate in this project, the research may be used by other researchers and regulatory authorities for future research.

Who is funding the research?

This research is funded by the Privet Applied Sciences University in Jordan.

What should I do if I have any concerns or complaints?

If you have any concerns about the project, please speak to the researcher, who should acknowledge your concerns within ten (10) working days and give you an indication of how your concern will be addressed. If you remain unhappy or wish to make a formal complaint, please contact [**please insert details, name, address and email**].

Fair Processing Statement

This information which you supply and that which may be collected a part of the project will be entered into a filing system or database and will only be accessed by the researcher and supervisor involved in the project. The information will be retained by De Montfort University and will only be used for the purpose of research, statistical and audit and possibly commercial purposes. By supplying this information you are consenting to us storing your information for the purposes above. The information will be processed by use in accordance with the provisions of the Data Protection Act 1998. No identifiable data will be published.

- Carpet test questionnaire instrument

Sustainable Interior Design:
A design guide of luxury sustainable material finishes for high-end hotel guest rooms

Participant background

Age:

- ☐ 22-30
- ☐ 31-40
- ☐ 41-50
- ☐ 51-60
- ☐ Over 60

Are you a:

- ☐ Researcher
- ☐ Academic
- ☐ Professional

What is your background?

- ☐ Architect
- ☐ Technician
- ☐ Interior design
- ☐ Textile design
- ☐ Fashion design
- ☐ Product design
- ☐ Product and furniture design
- ☐ Fine art
- ☐ Footwear design
- ☐ Design craft

Please answer the following questions based on the carpet samples you will see.

From the samples provided, which is the carpet you would like to see in your room if you stayed in a five-star hotel? (Try and ignore the colour)

- ❖ Tick the sample you deem acceptable; repeat this for each question.

☐ A

☐ B

☐ C

☐ D

☐ E

☐ F

☐ G

☐ H

☐ I

☐ J

☐ K

☐ L

☐ M

☐ N

☐ O

☐ P

☐ Q

1- In terms of texture, which is your preferred sample?

☐ A

☐ B

☐ C

☐ D

☐ E

☐ F

☐ G

☐ H

☐ I

☐ J

☐ K

☐ L

☐ M

☐ N

☐ O

☐ P

☐ Q

2- In terms of thickness, which is your preferred sample?

☐ A

☐ B

☐ C

☐ D

☐ E

☐ F

☐ G

☐ H

☐ I

☐ J

☐ K

☐ L

☐ M

☐ N

☐ O

☐ P

☐ Q

3- Overall, which is your preferred sample? (Choose one only)

☐ A

☐ B

☐ C

☐ D

☐ E

☐ F

☐ G

☐ H

☐ I

☐ J

☐ K

☐ L

☐ M

☐ N

☐ O

☐ P

☐ Q

4- Please choose the best five samples in your opinion and rank them in order from 1 to 5. where is 1 is the best.

☐ 1 …….
☐ 2 …….
☐ 3 …….
☐ 4 …….
☐ 5 …….

Thank you.

Appendix D: Research activities

- Conference paper **(International research conference on sustainable energy, engineering, materials and environment)** held in Newcastle upon Tyne, 26-28 July 2017.

International Research Conference on Sustainable Energy, Engineering, Materials and Environment

Meeting the needs of sustainability, economics and luxury in the specification of hotel interiors

Ruba Jadallah, Peter Ford and Rosemarie Fitton

School of Art and Design, De Montfort University, Leicester

ABSTRACT. The hospitality industry and specifically luxury five-star hotels have started to adopt a more active approach to sustainability and applying it within their construction and operational practices, utilising LED lighting, recycling water, and reducing the washing of towels, thus saving hotel owners money and reducing impact on the environment. In addition, there is a need for 'green' hotel buildings to provide both guest and employees with a healthy and comfortable indoor environment. However, there is the potential for a contradiction here in terms of sustainability and luxury in the context of the indoor environments for five-star hotels in terms of materials and finishes, that is the need to preserve resources could have a negative impact on the superiority and luxury 'wow' factor of the five-star hotel experience. In this paper, the researcher explores these important concerns and limitations regarding the hotel industry and its move to become more sustainable. In particular, this paper considers an approach whereby interior designers can address and balance both the need to select material finishes which create a five-star luxury feel and which reduce environmental impact. This paper is based on a comprehensive literature review conducted to identify these conflicts in addressing 'green' indoor and luxury hotel environments. As such, this paper proposes an approach to analysing materials and finishes that can contribute to 'green' hotel, indoor environments while maintaining a 'luxury' experience. The paper addresses the needs of hotel owners, designers, suppliers and the environmental assessors BREEAM, proposing a guide to assist hotel owners/developers produce cost effective, safe, healthy and comfortable environments. In addition, it will help designers in selecting luxury sustainable material finishes for hotel buildings. The hotel industry needs more research on sustainability. Studies such as this will provide interior designers with an informed process on specifying for sustainability and luxury in the context of the design challenges they face in the hospitality field.

- Presenting the accepted paper for the IRCEEME conference 26 July, 2017.

Awards and Certificates:

- Was awarded 3rd prize in the research degree students' 3 minute thesis competition.
- BREEAM Associate Certificate, awarded in 2017.

Conferences and Exhibitions:

The researcher attended the following conferences and exhibitions in London during the study period:

- Eco build exhibition 8-10 March 2016 and 7-9 March 2017
- Sleep: the hotel design even 22-23 November 2016
- Surface design show 7-9 February 2017
- Decorex international 17-20 September